HARVARD COLLEGE
AUG 8 1888
LIBRARY.

THE TELEGRAPHIC JOURNAL AND
Electrical Review.
VOL. XXIII.—No. 557.

THE EDISON-SWAN MONOPOLY.

THE Cheesbrough patent which is upheld by Mr. Justice Kay is a somewhat curious document. It was taken out in 1878 by Cheesbrough as agent for Sawyer and Man. The original patent was made up of two American specifications tacked together. The body of the specification is devoted chiefly to a description of an extraordinary low resistance semi-incandescent lamp. The title was "Improvements in and relating to electrical lamps and to a method of charging such lamps with an artificial atmosphere and purifying same, and to the production of a carbon for use in electrical lamps and for other electrical purposes." The specification described all this in full, but the title has been cut down and the patent has been reduced till it only covers deposited carbons and a method of getting rid of occluded gases. Out of the original 30 claims only three remain.

Mr. Justice Kay has, as we have already stated, studied the subject so thoroughly that his judgment is no doubt quite correct with reference to the evidence before him, and we have nothing to say on that point; but we are a little inclined to think he was misled by some of the witnesses. He was led to suppose that Cheesbrough described the process of making a carbon uniform along its length by electrically heating it so that the carbon was deposited on the hottest places, thus making a carbon uniform in resistance. Cheesbrough describes heating a carbon in a carbon gas, and if a carbon is heated in a carbon gas the result just described is obtained; but Cheesbrough does not point out that such a result is obtained, nor is it his object to obtain it. His object is to get homogeneous material which he might, if he desired, cut up for use. He mentions that "carbon of the ordinary sort, when heated by the electric current, exhibits points and lines of unequal brilliancy. Carbons prepared by this process, when so heated, glow with a uniform brilliancy throughout." Read with modern knowledge this looks as if he understood the process of equalisation, but a glance at the context shows that he merely means that a carbon of the ordinary sort is not homogeneous, while his is hard and dense and homogeneous. He merely describes what he considers to be the effect of the extra hardness and density produced by his process. No doubt if the applicants did not understand the action when they took out the patent they must have understood it soon after; but that is not the point, a workman would not have found the equalising process in the specification.

The defendants made very little of the point that the specification is chiefly devoted to the description of a semi-incandescent lamp. The workman would read the whole of the description of the electrical heating as referring to semi-incandescent lamps, and would have nothing to turn his attention to incandescent lamps till the very end, where the patentee casually remarks, "Let it be supposed that the pencil of carbon is held between two carbon pieces of greater mass . . . . the pencil and its holders, without having been disturbed, are placed in a globe in which they are hermetically sealed." This is the only reference to incandescent lamps in the whole specification, and the whole of the rest of the description, and the whole of the drawings refer to semi-incandescent lamps, yet the judge was led to suppose that the process of making an incandescent lamp carbon uniform along its length is described clearly enough for a skilled incandescent lamp workman, who, by the way, did not exist in 1878.

Of course incandescent carbons may now be made so well that they do not need to be made uniform along their length artificially, but merely need to be standardised. Still some of the carbons would be improved individually by flashing, so that argument will not clear an infringement. Granting that Cheesbrough patented electrical heating for one purpose, using the process for other purposes which involve Cheesbrough's, is not outside the patent. If one man invents a machine which makes cartridges of a stronger kind, and another man finds that the machine makes them all alike so that they fit the same gun, in addition to making a stronger cartridge, he cannot use the machine without a license.

The effect of Mr. Justice Kay's judgment is then to stop flashing. It is really quite marvellous to see that the various lamp makers, other than the Edison-Swan Company, now find that flashing has all along been a mistake, and that their lamps are much better without it. Each maker also thinks his lamp is the only one that can be made without flashing, and that all the other makers will be stopped. A few years ago makers discovered that particular kinds of surfaces had the curious property of radiating light easily, but objected to radiate heat, so that at a given temperature they gave a higher efficiency than other surfaces. The curious thing was that each maker found this strange result with his own surface and with that of no one else. A white surface was generally considered to possess the desired properties, and a hollow carbon was also preferred; but now that the Edison-Swan Company have the monopoly of white surfaces, they will no doubt claim that white surfaces radiate more of the energy as light at a given temperature, while others will find the property is confined to black surfaces.

For ourselves, we think that the Cheesbrough patent will give considerable trouble to all lamp makers. If flashing were not a very convenient process it would not have been employed so nearly universally. Of course one way out of the difficulty is to make so many lamps that enough of any desired electromotive force can be selected from the finished lamps. This used to be done in early days, but it would be difficult to make lamp manufacturing pay with such a process.

The Cheesbrough patent may, however, probably have one good effect which will help English makers;

it should prevent the importation of foreign lamps. It will not be worth the while of a foreign maker to give up flashing altogether, just for the sake of the English market, and it will not be worth his while to make a special lamp unflashed. On the above supposition, therefore, it may be that Continental and American lamps will not compete with English lamps at all.

Last Friday's *Standard* contained a telegram from New York, saying surprise is felt at the result of the action, as in the States Weston is held to have anticipated both Edison and Sawyer and Man. It must be remembered that patent law is, if possible, more curious there than in England. An invention does not date from the application for a patent, but from the date of invention, so that a patentee never knows whether someone else may not claim the invention with a later patent by swearing he invented it earlier, or "swearing back" as it is called. We think in this case there is some confusion, and that the Sawyer and Man patent referred to is that for paper carbons, which was held to anticipate Edison, and not the flashing patent. We should think it likely that such a sharp electrician as Mr. Weston would naturally be very early in the field.

FROM the report and accounts of the Metropolitan Railway Company for the half year ending 30th June last we extract the following :—"The Electric Traction Company have not yet completed their arrangements for an experimental working, by an electric power locomotive, on a section of your railway. They state, however, that the locomotive will be ready, and the working commenced about October next. The following letter has been received from the Traction Company :—

The Electric Traction Company, Limited,
New Broad Street House, London, E.C.,
11th July, 1888.

The Board of Directors of the Metropolitan Railway.

Gentlemen,—The delay which has taken place in the practical demonstration on your line of an electrical engine, working in with your other trains and taking part in your ordinary traffic, is not owing at all to electrical difficulties. On all points in which electricity alone is concerned, we are prepared for the demonstration, and I am happy to say that we shall be able to work with a single charge for a longer time than that specified by you in our contract.

The delay has arisen from a cause which very indirectly concerns electricity, and is purely mechanical.

The vacuum brake is fitted on all your trains, and the vacuum is created by steam from your engines. We must, in order to avoid any change in the arrangements of any part of the train other than the engine, provide means of making a vacuum without steam. We have been in consultation with the Vacuum Brake Company, and hope that this purely mechanical difficulty, though it has caused unavoidable delay—not entirely attributable to us—will now disappear. On all other points we are ready.

I am, Gentlemen, your obedient Servant,
(Signed) BURY,
Chairman Electric Traction Co., Limited.

Lord Bury once wrote an article, we believe in the *Nineteenth Century*, dealing with domestic electric lighting from primary batteries, or rather from a special type of battery. It showed pretty plainly that whatever other qualifications his lordship possessed electricity was not his *forte*, and the paper was soon forgotten. The mistake he then made was sufficiently grave, but it seems to us that the wild scheme upon which he is at present engaged bids fair to outdo everything which has hitherto been characterised as wild and preposterous in the electrical world. That a vacuum will be produced by the Electric Traction Company's locomotive we have no doubt, but it will be in the coffers of the company.

IT is gratifying to learn that telegraphic communication has, after a stoppage of eighteen days, been re-established between Australia and other parts of the world. Australia having experienced the great advantage of being moored to the mother country by submarine telegraph cables, has just cause to complain, when, owing to no fault of hers, she is so suddenly cast adrift. No doubt, in the early days of submarine telegraphy the blind were leaders of the blind, and for that reason many things were done which it would not be fair to criticise or censure by the light of more experience; but now, if what that experience has taught is ignored, and those in authority still choose to wander in the old way, they richly deserve to lose the confidence which has been reposed in them. The history of the Australian cables is a case in point, which will not, we think, redound to the credit or further the advancement of submarine telegraphy, therefore we refrain from giving it, contenting ourselves by recording a few facts which may be of interest and serve to refresh the memory. In November, 1871, about 1,100 knots of cable were laid from Port Darwin to Banjo-wangie, and thus was telegraphic communication first established with our Australian colonies. In the June of the following year a fault developed itself in this cable, and it was not until the October of the same year that it was repaired, thus telegraphic communication with Australia was stopped for about five months. No doubt it was the inconvenience caused by this cessation that made the colonists agitate for a duplicate cable which they eventually obtained by liberally subsidising. This duplicate cable was laid in 1880, and, as far as we know, this is the first time since then that communication has entirely ceased. We think that those who so largely contributed to these cables ought to be willingly supplied with the information for which they will doubtless ask. It is only by such mutual confidences that submarine telegraphy can ever attain the exalted position which so important a branch of electrical science should occupy.

WE have previously commented upon the injudiciousness in certain cases and under peculiar circumstances of sub-letting electric lighting contracts. An instance of this kind which led to quarrelling, disputed accounts, threatened law suits, and which finally ended in arbitration, has just been brought to our notice. It seems that this last-mentioned method of settling disputes is open to grave doubt as to its efficacy, as the following lines will show. Both the contending sides had counsel, solicitors, and expert witnesses in attendance, and the arbitrator was a gentleman well-known in the electrical world. In his award occurs this paragraph :—"Now I the said . . . . having taken upon myself the burthen of the said reference and having heard counsel for the said parties and having heard examined and considered the allegations witnesses and evidence of both the said parties produced before me, &c." Now what is complained of is that no witnesses for the defendant were examined at all, although their evidence might have placed an entirely different construction on the question at issue. Another curious point is that the arbitrator freely admits in his award that the plaintiff did not use proper materials in some portions of the work, and executed others in an improper and unworkmanlike manner, so that the defendant suffered damage therefrom, yet the award was decidedly favourable to the plaintiff, although bad workmanship and the use of improper materials were the chief points on which the defendant relied for his case, and which his witnesses were prepared to amply prove. The moral of this is that sub-contractors should put in bad work, submit the matter, if the contractor is dissatisfied, to arbitration, make out a good case for themselves and calmly await the result.

THE gentleman on this side who sends the "English Notes" to our estimable contemporary the New York *Electrical World* does not always seem to be so careful in ensuring accuracy as is altogether desirable. In the latest issue which has reached us we read that "The electric lighting of railway carriages, as carried out by the Great Northern Railway Company, has made considerable progress. The arrangement adopted is designed by Mr. Radcliffe Ward, and consists of a dynamo and set of accumulator cells which are carried in the guard's van. The dynamo is driven from the axle of the van through a special gearing device of Mr. Ward's by which the direction of rotation of the dynamo is constant and independent of the direction in which the van is moving. The light meets with much appreciation from the passengers." It so happens that the special correspondent of the New York journal has confused Mr. Radcliffe, the telegraph engineer to the Great Northern Railway with Mr. Radcliffe Ward, who although very jealous of the work he has done in electric locomotion will, we feel sure, give Mr. Radcliffe the credit for lighting up the Great Northern trains.

THE remarks of Mr. B. E. Sunny which we publish on page 95 anent the question of underground conductors for arc light circuits are very interesting. Leaving alone the theories which are advanced to account for the occasional breakdown of insulation, the experience of his company will perhaps prove of service to electricians on this side of the water, and the makers of lead-covered cables will also derive encouragement therefrom.

MESSRS. HAMMOND & CO. have just issued a pamphlet of nearly 100 pages, at the low price of 6d., explanatory of the present position and future prospects of electric lighting. It deals with the older form of illuminants and their disadvantages, how the electric current is produced, dynamo-electric machines, steam engines, technical terms, the distribution of the current, the incandescent lamp, the purity of the electric light, and many other matters relating to the new system of illumination.

IN speaking of the Electric Lighting Act of 1882, Messrs. Hammond & Co. say :—"Not only was the capital that might have been used for the purpose of the formation of central stations frittered away among patentees, but an Act of Parliament was passed, at the instigation of the Right Hon. Joseph Chamberlain, then President of the Board of Trade, *which made house-to-house electric lighting a commercial impossibility under the older systems of distribution, which necessitated underground wires and a disturbance of the public streets.*" Further on in reference to the 1888 Act, we are met with what appears to be a direct contradiction of the first statement so far as the wiring is concerned :—"This Bill has been re-introduced in 1888, and, as it provides for the abolition of the confiscation clause, and for a 42 years' tenure, it should prove an important measure to those companies that in the meantime start operations, there being no necessity to work under the old Act, *except in the case of using a system necessitating underground wires, which method, however, is the only permanent one possible.*" The various methods of distribution are fully dealt with, and it is evident that the authors do not believe in the employment of accumulators but that they pin their faith upon converters or transformers of the Lowrie-Hall type.

A VERY interesting portion of the pamphlet is that devoted to the consideration of whether it will pay capitalists to start central stations. The use of underground *v.* overhead conductors necessarily forms an important point when discussing such a project, and it seems that Sir Richard Webster, the Attorney-General, and Mr. J. Fletcher Moulton, Q.C., are of opinion that a company can run overhead wires without infringing the Electric Lighting Act. This being the case, Messrs. Hammond & Co. argue that with a properly designed converter system, there need be but little capital locked up in mains, and taking Brighton as a case in point, they prove to their own satisfaction that a good dividend can be depended upon. The brochure closes with some advice upon the establishment of local electric light companies, and estimates of the cost of various sized installations on the Lowrie-Hall system.

WE consider it would be well worth the while of electrical engineers, and also of the general public who take an active interest in the future of electric lighting, to study this compilation of Messrs. Hammond & Co., which deals in a very concise manner with most of the problems connected with this all-important subject, although as we have already intimated it treats on one system only as being, like Pears's soap, the best.

Science seems to go out of its way in its comments upon the Weymersch and O'Keenan primary batteries. Mr. Shedlock, who recently read a paper in America upon the last-named type of galvanic element, stated the cost to be about one cent per hour for a 12 candle-power lamp. If, says *Science*, we add the cost of breakage of lamps, interest on investment, depreciation, &c., it will be found that the total cost is at least double this. This may be very true, but why rake up these items which form part and parcel of every electrical installation ? We are glad to see, however, that our American contemporary thinks that to whatever uses the Weymersch battery may be put it is certain that the tests we tabulated make an excellent showing.

IN summing up the result of the law suit between the Edison-Swan Company and the Anglo-American Brush Corporation, *Engineering* makes the following comment :—"Thus ends, for the present at least, a case which has been fought out on both sides with the greatest ability, and which will take its place among the *causes celèbres* of the electrical world. It furnishes another evidence of the persistent way in which truth can lie hid, for the same ground had already been gone over in two courts with an opposite result." Surely our contemporary makes a grave error, for this is certainly the first time in which the defendants have gained a point on the strength of attempting to show the invalidity of the Edison patent.

LIGHTNING.

By S. A. VARLEY.

(*Continued from page* 68.)

I further state in another part of the paper I have quoted from :—"The retardation which the magnetisation of an electro-magnet opposes to the *demagnetisation* of another one is well known, and is explained in Culley's 'Handbook of Telegraphs,'[*] in connection with the description of C. F. Varley's translating system. The author refers to it because he is most anxious to advance only that which is the result of his own direct experiment, or is based upon well-established laws generally accepted by leading electricians."

The quotations given from my paper of 1870, demonstrate, I consider, that what is now known as self-induction, and on which so much light has been thrown by the researches of Prof. Hughes, is in itself no new discovery, and I further think it may be fairly claimed for me that I grasped its significance. Prof. Hughes's experiments were all made, I believe, on short conductors. My first observation of it was made on a much grander scale, and I think the conclusion I came to—that it is a consequence of the magnetic polarisation of the conductor—is the more correct explanation, and if this be so, then the term magnetic inertia might be substituted with advantage, in my opinion, for the term self-induction as more correctly indicating the source of the phenomena. Magnetism in its relationship to electric motion I have been disposed to consider, now, for some years, as the analogue of ordinary inertia, for it seems to me to resist the electrical motion of the atoms of matter among themselves inside the conductor in a precisely similar manner as ordinary inertia resists the motion of matter bodily.

In 1862 I made the observation that if a galvanometer were wrapped with two wires side by side of the same gauge and adjusted to have the same resistance, that when a battery circuit was closed through them one of the wires had invariably a greater influence on the magnetic needle than the other.

And I found the only way of producing a perfect differential galvanometer with exactly the same number of convolutions in both the insulated wires was to make them of wire drawn down from the same sample of copper, and this experience led me to commence the construction of apparatus to try experiments on what I called the magnetic moment of metals. I proposed to charge a paper condenser with 500 Daniell cells, and to discharge it through single straight conductors of various gauges and different metals, mounted between upright terminals in the neighbourhood of a delicately suspended astatic needle carrying a mirror. I was prevented at the time from carrying out these experiments, and the opportunity has never occurred since. But what I had already learned from my observation of the lightning discharge in the neighbourhood of Therapia, and my experimental investigations in connection with it, justified me, I considered, in anticipating that a conductor of small gauge would produce a greater deflection of the magnetic needles than a conductor of a larger gauge. I regarded the difference of resistance of the conductors with the high potential and mode of conducting the experiments as a negligible quantity. My reason for anticipating a wire of small sectional area would produce a greater deflection than one of larger size was that there would be less magnetism developed locally and therefore there would be more free force to act on needles outside.

I should be glad even now to carry through these experiments, but I am disposed to think that the researches of Professor Hughes and Professor Lodge indicate to a considerable extent what would be the results likely to be obtained.

Some few years ago I had the pleasure of showing Professor Hughes some magnetic experiments, when he immediately demanded of me how I explained the action of a magnet through space. I replied that in my opinion the force was communicated in a precisely similar way as through a bar of iron, in other words, that there was a chain of matter, or some entity equivalent to matter, which connected the magnet, and the body acted upon through what we call space, and I said I ventured to go farther than this and say that where there was no matter there was no magnetism, no electricity, nor force of any kind, and I was glad to find the views I held coincided with those of Prof. Hughes. If we assume magnetic inertia to be the analogue of inertia of matter regarded in the mass, then given a similar sectional area and shape in the conductors the magnetic inertia of each conductor would be perhaps expressed in terms of its electrical resistance; or to put it more plainly, if we regard magnetic inertia as the analogue of the inertia of matter regarded in the mass, then the specific resistance of the conductor would possibly represent its weight or resistance to electrical motion.

Iron and the magnetic metals would be the densest of substances if expressed in terms of magnetic instead of terrestrial gravity, and they would not seem to follow the law I have suggested.

Since the above passage was set in type I have referred to Professor Hughes's presidential address to the Society of Telegraph Engineers, which, I am sorry to acknowledge, I have never given that attention to which its importance deserves, and I find his experiments go to show that self-induction is not related in any way to the specific electrical resistance of the conductors. I have not, however, withdrawn the passage because I think I am generally correct in my contention that the inertia which is manifested by a soft iron core around which an electric current is circulated and the inertia manifested in the conductor itself are referable to a common cause, the only difference between them being one of degree. I cannot help thinking that among our scientists of the present day there is far too great a tendency to elaborate and coin new phrases, whereas the aim should be to simplify and to link all phenomena and apparent anomalies observed to the common cause from which, if we could but see it, they most probably emanate.

The analogy between magnetic and terrestrial gravity appears to me to be so very complete; as an example, I might refer to the well-known fact that if a large mass of matter be suspended in space, a continuously applied force, however small, will, after overcoming the inertia of the mass, set it in motion; so also will a continuous current of electricity develop and maintain much or little magnetism accordingly to the length and mass of the electrical conductor and the mass of iron subjected to its influence.

In all dynamos, but more especially in shunt-wound machines, advantage is taken of this, and in some of the best examples the energy diverted in maintaining the magnetic field as well as that consumed in the armature is as low as from 3 to 5 per cent. If the analogy existing between magnetic inertia and material gravity, to which I have directed attention, can be shown to be complete, its scientific importance can scarcely be overrated, as it would place an instrument of research into our hands which would enable scientists to arrive at a fuller knowledge of the nature of gravity, a force, situated as we are in respect to it, so difficult for us to investigate.

Ever since I had the good fortune to discover the dynamo principle in 1866, I have striven to obtain a fuller explanation of it by studying the nature of the forces as a whole.

Our scientific professors appear to me to have been satisfied to accept this discovery without comment, and to regard the matter as explained when they say it is simply the conversion of one force into another. No one seems to have cared to ask the question how it is that by the expenditure of mechanical force in a machine, a fulcrum can be developed in the machine itself which resists the motion of the machine with a force proportionate to that which has created it, and accounts for such resistance by transmitting its equivalent in the form of energy through an electrical conductor.

---

[*] Third Edition, page 210, published in 1868.

In the discussion at the Institution of Civil Engineers in January, 1878, which followed the reading of Messrs. Higgs and Brittle's paper, I called attention to this point, and stated I attributed the creation of electrical energy in a dynamo to magnetism being a force possessing inertia, and electricity being a force having little or, as I believed, no inertia. That it was the inertia of magnetism which created the fulcrum, and as a consequence of this inertia, when a dynamo was in action, electricity was developed *instead* of magnetism.

I stated I was led to take this view from an observation made shortly after I had constructed the first self-exciting dynamo.

I had designed a magneto step-by-step alphabetical telegraph, in which simplicity of mechanical construction was obtained from the employment of a very powerful field produced by permanent magnets, and I observed there was perceptibly very much less resistance to the revolution of the handle when the circuit was closed, and electricity consequently developed, than when the circuit was opened and no force was being transmitted.

At the first blush the fact that less force was being consumed when electric force was being transmitted appeared to be very anomalous; but after thinking over the matter, and sleeping on it for a few nights, I obtained the key to the solution of the problem, viz., that when the circuit was open I was magnetically polarising the armature cores and overcoming the inertia of magnetism, which may be likened to transmitting a given quantity of force through a circuit of very great resistance, and when the circuit was closed I was developing, in place of magnetic polarisation electricity, a force having but little if any inertia, and transmitting it through a circuit of very moderate resistance. When currents are developed by an alternating machine, the iron cores of the revolving bobbins in their passage between the opposite magnetic poles through which they pass in succession, if magnetised at all, are magnetised only to a small degree, electricity being developed instead of magnetic polarisation. A little reflection will show it cannot be otherwise, for were magnetism developed in the revolving armatures, the force would be consumed in the machine itself, and there would be no energy to be transmitted beyond the limits of the machine.

I would here point out that what is *commonly* termed the conversion of one force into another is not work, and consequently does not consume energy. Were it possible to obtain conductors having no electrical resistance, then the whole of the mechanical force consumed in giving motion to the machine would be transmitted in the shape of energy, and no force whatever would be absorbed after the magnetic inertia had been overcome in keeping up the motion of the vehicle or medium through which the energy is transmitted. I have said in the sentence immediately above what is *commonly* termed the conversion of energy, for I am disposed to doubt whether there is such a thing as the conversion of force of one kind into force of another kind. I am disposed to attribute what is termed the conversion of force to the balancing of one force by another force, or the balancing one form of energy by another form of energy, and it is in such matters as these that mathematical science is so misleading.

To the mathematician energy is an elementary entity, and when energy at one end of the chain disappears and its equivalent is manifested at the other end he regards it as a full and complete explanation.

I may explain what I mean, perhaps, more clearly by a familiar illustration. A customer goes into a shop to purchase a joint of meat; the butcher places the joint in the scale pan and balances it by means of a weight. Expressed in terms of gravity the meat and the weight are the equivalent of one another, and in a mathematical equation they are convertible terms; but I think it is quite possible, from the customer's point of view, they are not one and the same thing, and he would not be satisfied if the butcher were to send home the weight in place of the meat.

The development of electricity in a dynamo I regard as being produced in a somewhat analogous manner to what would occur if a mass of matter were bombarded with bullets discharged from a rapidly firing machine-gun; the motion of the bullets would be arrested and converted into heat. The simile would be more complete if we assume the revolving armature to represent matter bombarded on opposite sides, and the field magnets as matter bombarded on one side. I cannot resist the temptation to say a few words in respect to the Pacinotti armature in reference to its bearing to magnetic inertia, for I think it has never been done justice to in scientific treatises, nor does it seem to me that its *modus operandi* has been wholly grasped by our scientists.

I regard the Paccinotti armature in its theoretically more perfect form of the Gramme ring as being the most beautifully complete of scientific inventions. What I have never seen explained nor even suggested is the fact that both the magnetic as well as the electrical polarisation developed in one part of the ring is balanced by that developed in other parts, consequently there is no force consumed in the magnetisation of the armature, and it may be revolved in an active magnetic field, providing the collecting brushes are raised without consuming any force whatever, and, further, the commutation of the currents developed in alternate direction in the coils of the armature is performed in a perfect and natural manner by the revolving ring, which is, in fact, its own commutator. In an alternating current machine the magnetic polarisation that occurs in the armature cores is so much force diverted and lost.

What takes place when a Gramme ring having no electrical circuit is revolved in an active magnetic field is very similar to what occurs when a disc is revolved rapidly, the particles of matter composing the disc are put into a state of stress by what is very unscientifically termed centrifugal force, for it is simply a consequence of continuously acting on force (which can only move in straight lines) by a second force and so altering its direction that the force developed on one side of the centre of motion is in all parts of the disc balanced by the force on the opposite side being in the reverse direction, and therefore the disc as a whole is in a state of equilibrium, although the matter composing it is more or less in state of stress.

(To be continued.)

THE MECHANISM OF ELECTROLYSIS BY ALTERNATING CURRENTS.

IT is considered as an established fact, say MM. J. Chappuis and G. Maneuvrier in *Comptes Rendus*, that we cannot decompose sulphate of copper by alternating currents. The absence of all electrolytic phenomena in this case is explained by supposing that the copper deposited on each electrode is immediately re-dissolved by the inverse current. This negative experiment is even presented as a proof of the equality of the two successive induced currents as far as their quantity of electricity is concerned. We have been enabled to justify this explanation by rendering the decomposition of sulphate of copper visible, just as we have done with acidulated water, though this novel experiment is both more complex than the former (*Comptes Rendus*, June 18th, 1888),[*] and more difficult to carry out.

If we substitute in the platinum wire voltameter a strong solution of sulphate of copper for the acidulated water, currents of a mean intensity of 2½ ampères which previously produced a plentiful escape of detonating gas produce nothing in the sulphate except a considerable heating, but if we then reduce the dimensions of the electrodes to 0·1 millimetre in diameter and 20 millimetres in length (= about 6 square millimetres of surface) there appears at once an escape of gas and a deposit of copper.

The electrolysis succeeds equally well with copper electrodes of the same dimensions. As soon as the current passes we see arise a sheet of fine bubbles and a reddish brown cloud of pulverulent copper, and the electrodes themselves quickly take the aspect of spongy copper freshly reduced.

---

[*] See ELECTRICAL REVIEW for July 6th last.

It seems, therefore, to follow from the whole of our experiments that in electrolysis by alternating currents it is always possible to reach a sort of equilibrium between the rate of decomposition of the electrolyte and the rate of recombination of its elements.

When once this equilibrium is reached there is no longer, or, at least, there no longer appears an electrolysis properly so-called. But then all the circumstances which may make the former rate to predominate over the latter will cause the products of the electrolysis to re-appear; and, on the contrary, all which tend to make the rate of decomposition predominate will make such products again disappear.

In the first rank of the conditions which acclerate the electrolysis, we must name the *density* of the current, that is, the ratio of its mean intensity to the surface of the electrodes. It is evident that if on the one hand, we increase the quantity of electricity which traverses the electrode, and on the other hand, diminish the surface of the electrodes, we shall cause the rate of decomposition to predominate over the rate of re-combination and promote the appearance and the liberation of the products of electrolysis, as our experiments have verified in the electrolysis of acidulated water.

We conceive equally that the electrodes and the electrolyte may affect the rate of re-combination by their chemical affinities or their physical properties. The facility of electrolysis must, therefore, depend also on the nature of the electrodes and the electrolyte. This is what our comparative experiments have verified in the electrolyses of acidulated water and of sulphate of copper, both by platinum and copper electrodes.

We may further foresee that the greater or less rapidity of the alternations, all other things being equal, must play an important part in the appearance or disappearance of the electrolytic phenomena. For if we suppose that the succession of the two induced currents becomes so slow that the electrolytic products of the first current have disappeared from the electrode, whether by direct disengagement or by diffusion, before the products of the inverse current have appeared there, no more re-combination will be possible: each of the alternating currents will behave successively in the voltameter like a continuous current of brief duration. We see, then, that all other conditions being equal, a retardation of the alternations must facilitate the appearance of electrolysis, whilst the acceleration of the alternations produces the contrary effect. This we have been able to verify by direct experiments.

The use of dynamos with a separate exciter has enabled us to vary the rapidity of the alternations without affecting the mean intensity, nor, consequently, the density of the currents. On the one hand, by raising the speed of the machine from 1,500 to 2,600 turns per minute, we could raise the number of inversions from 100 to 173 per second. On the other hand, by suitably modifying the intensity of the inducing magnetic field, by means of the exciting current, we could keep the mean intensity of the induced currents constant. Under these conditions we have made the two following experiments:—

1. The machine turning at its ordinary speed (2,000 turns per minute, corresponding to 133 alternations per second). We regulate the intensity of the currents so as to maintain the state of equilibrium, that is, to cause all liberation of gas in a voltameter with acidulated water to disappear. If at this moment we let the velocity sink to 1,500 turns, we see the gas reappear and freely liberated at the electrodes.

2. When the machine is turning at its ordinary rate of 2,000 turns we regulate the density of the current so as to give a distinct and regular escape of gas. If at that moment we raise the speed to 2,600 turns, all the escape at once disappears.

In either case we can annul the effect of this variation of speed by a suitable modification of the density. Thus in the first experiment we can cause the gas to disappear again by enlarging the surface of the electrodes, and in the second experiment they can be made to reappear by reducing this surface.

We see, then, that the rapidity of the alternations and the variations in the density of the currents affect the electrolysis in opposite directions, and that it may be manifested with currents of low density if the alternations are sufficiently slackened. This explains how, in 1837, De la Rive could easily decompose acidulated water by the alternating currents of the magneto-electric machines then recently invented. He succeeded in realising the development of detonating gas on large platinum electrodes, having a surface of 8 square centimetres. His difficulty seems to have been to make the gas disappear, whilst ours was to make them appear. This difference results from the fact that the electromotor employed by De la Rive gave at most 50 alternations per second, whilst our dynamos give 100 as a minimum.

From this experimental study of the circumstances which affect electrolysis by alternating currents, we may deduce, along with the numerical laws of these phenomena, the general rules which ought to direct the utilisation of these currents for this kind of application.

DAWN AT OXFORD COURT.*

WE are beginning to be hopeful of the United Telephone Company! A contemporary announces that the West End exchanges are now to be kept open at night and on Sundays. This is not in itself a great matter. We cannot see, for instance, why the West End portion of the exchange alone should be kept open. We were under the impression that the danger of fire existed also in the City, and that City men were now and then to be found in their offices at night; that, in short, many uses for the telephone existed at night in the East as well as in the West, and in the North and South, too, for that matter. Moreover, as far as we know, there is not at this moment a telephonic exchange of any importance in any part of the world, *except London*, which is not open in its entirety day and night all the year round. But it is the fact that light appears at last to be breaking upon the Cimmerian darkness which, telephonically speaking, has so long enveloped the officials of the company that pleases us. The first streaks, as it were, became visible at the annual meeting, when the chairman announced that a few call offices, *for the use of the public*, were to be opened experimentally. It is true that his deputy, Mr. Forbes, emphatically condemned the idea; but we account for this by the fact that he was called on suddenly, as a reserve man, to stem the rising tide of hostility to the board which had developed in the meeting. There was little time to prepare his brief, still less time for him to study it, and hence he was found, in all innocence, speaking and approving of what *had been* the policy of the company, and in blissful ignorance of the new departure which criticism had forced upon his chief.

On another occasion we shall no doubt find Mr. Brand and Mr. Forbes, having had time for rehearsal, more mindful of Mascarille's advice to the musicians: "*Mettez, pour me jouer, vôs flutes mieux d'accord.*" And it will be Mr. Forbes who will have to tune up, not Mr. Brand who will have to tune down. The former—however cleverly, when it suits his book, he may throw ridicule upon others as having little knowledge of the subject of which they speak—would not, we feel sure, seriously claim to be a telephonic expert. Of the antediluvian methods of the United Telephone Company he may know much—his recent speech, indeed, convicts him of being an expert in those—but of modern telephony he knows nothing. Still less does he seem to grasp the situation as regards the future. Has he reflected, for instance, that it will be the votes of the "Tom, Dick, and Harry," whose patronage he floúts, that will decide how much his shareholders are to get for their property when the inevitable day of Government purchase arrives? Is he aware that his so-called crowded wires are really built so as to occupy the way-leaves which in any properly constructed exchange would be made to accommodate several times the number, or that his numerous central exchanges, the bases of his piteous description of the difficulties in the way of increasing the traffic, and the foundation of his marvellous theory of "cubes," are precisely one of the greatest blots upon the telephonic system of the metropolis? Clearly he is not!

---

* *Financial News.*

We commend to his consideration the propriety of making his system popular, and of examining the engineering changes which are going on around him in other companies and abroad. His idea of "getting the cream" is good, but he is far from grasping how best to secure it. Seriously, however, we are not at all apprehensive of any opposition on his part to reform. He knows as well as we do that the chairman is practically the company—that it is to Mr. Brand that it owed its origin, and to his incessant work that any measure of success which has attended its operations is chiefly due. It is this success financially, in fact, which has been its bane as a telephonic property. Had there been less easily skimmed "cream," we should have seen less slovenly telephoning. Had the company been under the necessity of earning its revenues out of its wires, like the provincial companies, with no fat royalties and nice little dividends to swell its receipts, we should have had less assumption of superiority and more practical work. We have condemned the company's management freely; we are quite ready upon cause shown to sing its praises. We believe we are not wrong in giving Mr. Brand the credit of the improvements we have noted. We believe, also, we are correct in supposing that he has been stimulated by criticism to undertake further reform, although what he has already accomplished has met with opposition, where in reality not only should there have been concurrence, but, long ago, initiation of the very reforms themselves. However this may be, we welcome the signs of change, and look forward with interest to further developments.

HOW JACK ASSMAN WAS CURED OF A COMPLAINT IN THE KIDDENS BY THE ELECTROPATHETHIC BELT.

THE following appeared in the *Cornishman* of last week:—

"Aw well! Iss, aw cured me; sure nuff, aw ded. And this wos how 'twas done. I went to the druggist's shop, for to git a dose of salts and siney for the cheeld that wos brave an poorly; and the maaster of the shop said to me, says he, 'Well, Jack, and how are you?' 'Well, sar,' says I, 'not well by a passle, and I abm ben well for a bra bit, not for a bra bit I abm. I spose I must a catched a cold and aw ben brave an long sure nuff and I caan't gid rid obm, do what I will.' 'What have e took?' says he. 'Well,' says I, 'I took a bra bit of old doctor's-trade I should think pon the whole; what weth pills and powders and bottle stuff, and all that there, I've took a bra piece of a barrowful, and aw don't seem to do much good.'

"'Well,' says he, 'Look here! Why don't you try one of these?' and he showed me a thing most zackly like a woman's stays. 'Why,' says I, 'What's that? Tes like a woman's stays, or a paart of the harness of a donkey. Why, what ezza? Good lor! Tie um round your cheens de? Jest like a bilt what you do wear when your cheens es bad? Wearen like that, do e, sure nuff?' 'Yes,' says the druggist-man, 'You do weer et round your loins for a complaint of that sort.' Says I, 'Iss sure: where do e wear'n for the toothache? Round your chacks I spose?' 'Well,' says he, 'Ef you do buy one you will have information all about et.' 'Iss,' says I, 'But what do e ax for a thing like that?' Says he, 'You can have a real good one for three guineas!' 'Three guineas!' says I, 'well, well, I don't git so much as that in a month; I don't. Three guineas is a passel of money for a poor man to pay. I caan't afford et now, that's what I caan't, but I'll tell my old woman about et and see what she says. But, lor, we couldn't afford three guineas I'm sure.' 'Well,' says he, 'tes worth more than twice that sum. Just you fancy, ef it should cure you it would be cheap in that money, and you could work better and soon get three guineas exter. Couldn't you?'

"Says I 'They do say *F* es a crooked letter and hard to be righted. *Ef* I do get cured, but then? *Ef* I could get the money: that's another *F* for e. Howsomever I'll ax Betsy about et; cause, seemen to me, I would do most anything to cure my kiddens.'

"So I went home and told Betsy and she said, 'Well, Jack, who can tell? The money may be got somehow, as Mary, the old sexton's wife, said when times was slight. I wonder whether he would allow e to abm by payen so much a month?' 'Dont knaw,' says I, 'I'm sure: you can ax of he: p'raps he will.'

"So we agreed that we would try um that way, and I went on just as before. Sometimes I should ax Betsy whether she was going to git the bilt for me and she would say 'Don't knaw yet, but wait a bit. Touch your pipe for a little longer; and who can tell?'

"So one day she came to me and showed me the bilt. 'Why,' says I, 'Betsy! what's that?' Says she 'What ezza like, do e think?' 'Well,' says I, 'jest as I said before—like a woman's stays or a paart of the harness for a donkey.

"'Well I'll wear the thing ef twiil do me good.' Says she, 'Try un on.' 'Where?' says I. 'Round your cheens,' says Betsy. 'Shart on or shart off?' says I. Says Betsy, 'The man told me it doant matter much; ef it do hurt pon the skin you can wear et outside your shart, cause the presperation in your shart do help a good deal and the Electropautic stuff do go right through and do good. Try et on,' says she, 'just inside of thy shart.' 'So I will,' says I: 'giben to me. Seemen to me my kiddens es feelen better now already,'

"So I took off my shart and put on the Electropathetic bilt, and buckled um up; and she said, "Ef thee cust feel et pricking like, tes a sign tes doing good to thee.' After a bit I feelt somethen pricking and ticklen. Says I, 'I can feel et! My kiddens es getten better!' Says Betsy, 'Arta sure tes the bilt doin et?' 'What else should do et?' says I; 'but how are we goin to pay far this?' 'So well as we can,' says Betsy.

"So I wore the bilt outside my shirt for a bra bit. And ef youll believe me I got a lot better. One day I said to Betsy, 'Sposen I do rite to the newspaper and say I was cured of a bad complaint in the kiddens by that Electropathetic bilt; twill do good for the man who made the bilt and—who can tell?—he may take off somfen from the price for me crying up his bilt.' 'Well,' says Betsy, 'All right; but stop a bit til aw de git quite well.' 'All right,' I said.

"So I stopped and got bra an well, and rote to the papers, and praised up the maker of that bilt to the skies, and said that it cured a complaint of the kiddens of seven years' standen; and that the bilt was worth its weight in gold; and a bra lot besides.

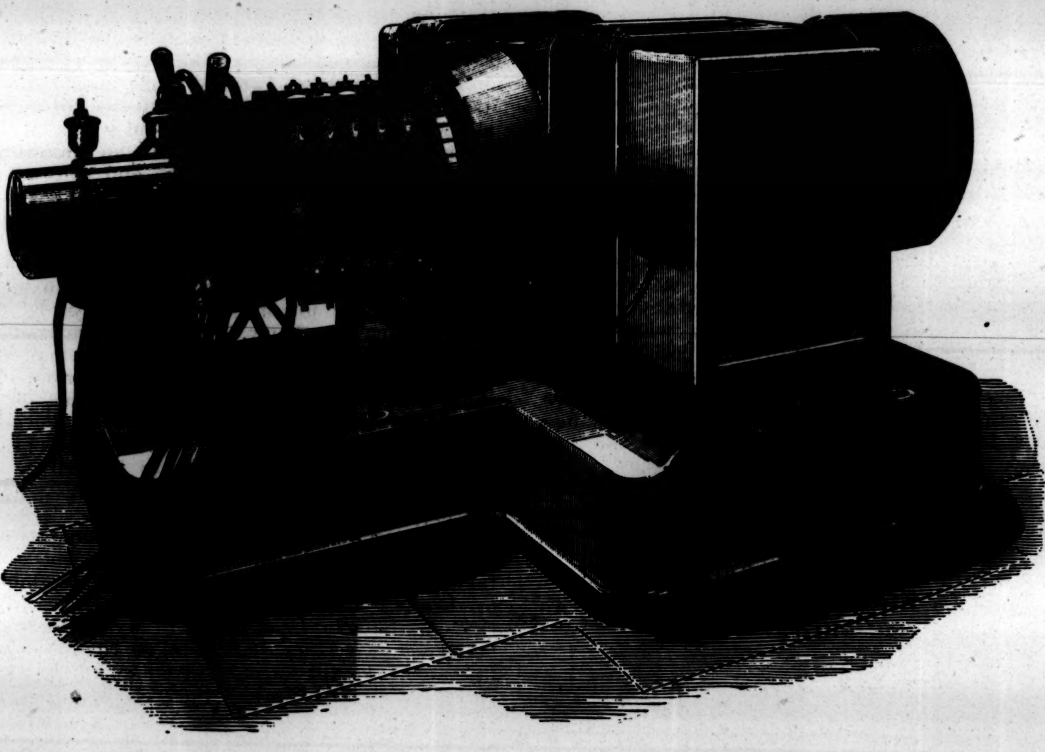
Betsy's Account of the Cure.

"Iss Jack was cured, or aw said aw was, and I spose aw was, sure nuff. But aw ded'nt know that I made the Electropathetic bilt myself. I ded. I made et out of a stays of the maid Mary's, and sewd into um a lot of tin-moneys and temberen buttons, and thought they might do so will as the bilt itself; and whether aw was faith or works that done the cure I never knowd, *but I saved the three guineas and cured Jack at the same time!*"

ELWELL-PARKER ELECTRO-DEPOSITION DYNAMO.

WE illustrate a large machine specially made by Messrs. Elwell-Parker, Limited, for copper depositing. This is one of a set of three which have now been at work for some months running continuously night and day, making a total run of about 160 hours per week. Their normal work is 50 volts, with a current of 1,500 ampères; when there is a large quantity of copper in the vats, this amount is increased to 1,700 or 1,800 ampères.

The machines are of the 4-pole type, with drum armatures, there being four sets of brushes to collect the current. The magnets are very heavy and short, giving a strong magnetic field. The total length of wire on the surface of the armature is 1,600 inches; for comparison with 2-pole machines, this must be halved. The peripheral speed is 2,500 feet per minute, and the revolutionary speed 450.



The machines run without sparking when carrying their full load. Hitherto it has not been usual to make machines for over 1,000 ampères, many now in use for copper depositing only giving 500 ampères. There are many advantages gained by using large machines giving heavy currents; the size of vats may be increased, and the cost of and the attention required by a few large machines is much less than that for a number of smaller ones to do the same work.

A machine of the same size and type as the above, but suitably wound, is now in use for operating the Portrush tramways. This machine gives with no load 300 volts, increasing to 400 volts as the current is taken from it up to 200 ampères; this is necessary on account of the resistance of the line. The speed of this machine is also 450 revolutions.

On the periphery of armature there are 304 wires, or a total length of 6,080 inches; the length of active wire per volt being $\frac{6080}{2 \times 400} = 7{\cdot}6$ inches at a speed of 2,500 feet per minute. The total length of wire on the armature, including the wire across the ends and connections to commutator, is 12,760 inches. This gives $\frac{12760}{2 \times 400} = 15{\cdot}95$ inches per volt at 2,500 feet.

THE EDISON GROUND DETECTOR FOR ELECTRIC LIGHT CIRCUITS.*

By A. E. KENNELLY.

IT is a matter well known to electrical engineers that the difficulty of locating the position of a ground in electric light circuits varies directly, other things being equal, with the weight or cross-section of the mains. In other words, an error in the determination, which would represent a displacement of the ground from the true position to the extent of 10 feet in mains whose sectional area is 5,000 circular mils., would, under similar circumstances, induce an error of 200 feet in mains of 100,000 circular mils. cross-section. It consequently follows that in most cases of grounds in mains of considerable size, the location cannot be carried out practically to anything approaching the degree of accuracy that it would be desirous to attain. Thus, while a localisation to the limit of one hundredth of an ohm accuracy generally requires considerable time, care, experience and calculation, such an error would involve a displacement of 100 feet in mains of 100,000, and of 200 feet in mains of 200,000 circular mils. section. The consequence is that in all such cases the slow process of digging and disconnection has to be resorted to, first by ascertaining between which pair of safety catch boxes the ground lies, then by sinking a hole in that half section, next in the quarter section, and so on until the final tube is arrived at. Much time and labour would therefore be saved if some practical method could be devised of detecting directly from the surface-level the position of the fault.

The telephone has been tried, and is still sometimes employed, in connection with an induction coil carried over the pipe line, while a current from a few cells of battery is passed through the mains in that section; but so far as has come to our knowledge the success attained by this method has not hitherto been very great, partly from the great delicacy of the telephone, which is liable to confusingly pick up and mingle induction currents from other neighbouring conductors, and partly for the reasons that are about to be given.

With the object of solving the problem more satisfactorily, Mr. Edison instituted at his laboratory experiments which have resulted in the use of a device, which, though not yet capable of locating definitely the position of a ground in a main, may materially economise the time and labour expended in the subdividing sectional process.

---

* *Electrical World.*

The principle employed has been nothing more than the deflection of an ordinary magnetic needle by the magnetic force of a current passing beneath it.

The extent to which this principle can be adopted—that is to say, the limit of the ground resistance, which can, under ordinary circumstances, be so detected from the surface of the street above—is easily capable of estimation.

We may first observe, and the fact is frequently of great practical utility, that the vertical distance which must intervene between a long horizontal conductor in the magnetic meridian carrying a current and a small pivoted compass needle above it in order that the needle shall be deflected through an angle of 45°, is approximately in centimetres (about 30 centimetres to the foot for practical purposes) the number of ampères that the conductor steadily conveys. Thus if a long horizontal wire in the magnetic meridian carries a current of 30, 40, or 50 ampères then a short compass needle placed vertically over it would be deflected approximately 45° from its normal position parallel to the wire, at elevations of 30, 40, or 50 centimetres; *i.e.*, 12, 15, or 20 inches respectively above it.

As this at first sight appears to be an infraction of the law of inverse squares of distances applying to electro-magnetic action, the proof of the proposition may not be out of place.

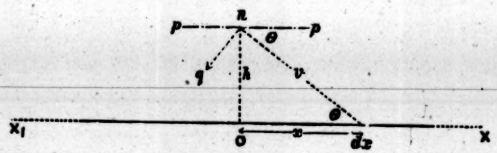


FIG. 1.

Let X¹ O X in fig. 1 represent a long (in theory infinitely long) horizontal conductor placed in the magnetic meridian, and let *n* be the pole of a small magnetic needle vertically above the point, O, by the height, *h* (centimetres). Let the wire convey a steady current of strength, *c*, in absolute measure. Then the pull which any very small element of the wire, *d x*, such as that in the figure at the distance, *x* from O and *v* from *n*, will exert on the pole. *n*, is, by Ampère's law, equal to the length of the element multiplied by the strength of the current and divided by the square of the intervening distance. That is, the element of force

$$d\,\mathrm{F} = \frac{d\,x.c}{v^2} = \frac{d\,x.c}{h^2 + x^2}.$$

But this force, *d* F, will be exerted at right angles to the vector, *v*, or in the direction, *n q*, and the horizontal component of it will be that fraction of *d* F represented by the cosine of the angle, *p n q*; that is, by the sine of the angle, *r n d x*, represented by θ in the figure; that is, by the ratio of *h* to *v*, so that the element of horizontal force

$$d\,\mathrm{H} = \frac{d\,x.c}{h^2 + x^2} \times \frac{h}{v} = \frac{d\,x.c.h}{(h^2 + x^2)^{\frac{3}{2}}}.$$

The total horizontal force acting on *n* will be the sum of all the forces due to the little elements like *d x* all along the wire; that is, in the language of the integral calculus

$$\mathrm{H} = c\,h \int_{-\infty}^{+\infty} \frac{d\,x}{(h^2 + x^2)^{\frac{3}{2}}}.$$

This becomes, on integrating:

$$\mathrm{H} = \frac{2c}{h}.$$

Suppose now that this H, being the deflecting force on the needle, the directing force of the earth's magnetic field is $\mathfrak{H}$. Then the needle will deflect until a position of equilibrium between these two forces is attained, that is until H cos $\phi = \mathfrak{H}$ sin ϕ, where ϕ is the angle of deflection. Or,

$$\frac{\mathrm{H}}{\mathfrak{H}} = \tan\phi.$$

Or

$$\frac{2c}{\mathfrak{H}\,h} = \tan\phi.$$

Now if ϕ be 45° its tangent is 1, and we have

$$h = \frac{2\,c}{\mathfrak{H}}.$$

$\mathfrak{H}$, the earth's horizontal component, varies between different places, but is practically constant for one place. It is about 0·17 for New York. In Mr. Edison's laboratory (galvanometer building) at Orange, $\mathfrak{H}$ is 0·189. The current, *c*, being in absolute measure must be divided by 10 if given in ampères, so that the equation becomes:

$$h = \frac{2\,c}{1{\cdot}7},\ \text{or}\ h = 1{\cdot}18\,c.$$

That is, for practical purposes the height, *h*, in centimetres is the current, *c*; in ampères approximately. At any place where $\mathfrak{H}$ has a different value the true formula is:

$$h = \frac{2\,c}{\mathfrak{H}\ \tan.\ \phi}.$$

From this it follows that a current of about 60 ampères flowing through an underground main in the magnetic meridian would deflect a needle at the surface, two feet above, 45°. As it would generally be impossible to work with so large an intermittent current flowing through the ground from the main, and as it would be quite unnecessary to have so large a deflection as 45°, we can suppose that 5° shall be a good and reliable deflection to employ, and we have from the preceding equations:

$$c = \frac{h \tan 5^\circ}{1{\cdot}18} = 4{\cdot}5\ \text{ampères}.$$

That is to say, a current of 4½ ampères in the magnetic meridian at 2 feet would deflect the needle 5°. Supposing, as is generally the case, that the wire is not laid in the magnetic meridian. Then the needle must be brought parallel to the wire by the aid of a small controlling magnet. In so doing it may be necessary to increase the directive force on the needle by 50 per cent., and therefore it may take as much as 6¾ ampères to produce 5° deflection. That is, however, a safe limit.

If a supply of current be available at a potential difference of 100 volts, then this current of, say 7 ampères, can be produced through a ground of 14 ohms resistance, and, consequently, 14 ohms would be the limiting resistance of a ground that could be detected from the surface level above the tube, with 100 volts E.M.F.

Experiments seem to show that the iron pipe enclosing the mains does not reduce the deflection produced by the current to any serious extent. Consequently it might be expected that if a compass needle were carried above the surface over the mains and a perodic current of 7 or more ampères were sent regularly through the grounded main, free at the distant end, then the deflection of the needle from its position of rest (under weak artificial control), parallel to the pipes, would serve to indicate that the ground was still ahead of the observer; while the cessation of the current would indicate that the ground had been passed and that the current had left the main.

The instrument constructed for this purpose is a compass box swung on gimbals containing two light, strongly magnetised needles, rigidly connected by a thin aluminium strip that also serves as pointer over a graduated dial. By this means the moment of inertia of the needles and pointer is small and its movements are quick. The whole is clamped at the lower end of a stick held in the hand. A small controlling magnet to bring the needle parallel to the line of tubes has generally to be carried on a clamp above the needle or laid on the ground near it.

It is found in practice, however, that the surface indications of the needle are largely vitiated from the fact that the escaping current does not enter the ground directly, but spreads itself in both directions along the iron tubes and in that way acts upon the needle for a certain distance, much in the same way as when in the main within.

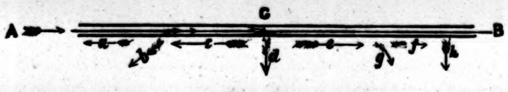


FIG. 2.

Thus, if fig. 2 represents an iron pipe containing the mains, and G is the point at which the main is in contact with the tube, then the current there leaving the main generally divides into three parts, one returning to the source of supply along the pipe and the ground in vicinity, as shown by the arrows, *a*, *b*, *c*; a second part may be supposed to enter the ground direct, in the immediate neighbourhood of G, as indicated by the arrow, *d*; while the remainder will continue to flow along the outside of the pipe in the direction of the arrows, *e* and *f*, in search of ground all along, and thus diminishing in strength as the current quits the pipe, as shown by the arrows, *g* and *h*. Hence, supposing that the current flowing from A to G through the main is 7 ampères, and that the part returning *via c* and *a* is 4 ampères, while the currents *via d* and *e* are 1 and 2 ampères, respectively—then the effect of the currents in the tube as a whole will be only to the extent of (7−4) or 3 ampères on the compass needle above *c*; while beyond the ground, over *e*, there will be an effect of 2 ampères. Owing, therefore, to the conductivity of the iron pipe, the effect of the main current on the needle is found to be materially reduced, and instead of finding a critical point at which the main current definitely ceases the observer is led to a greater or less distance past the ground by the diminishing currents of *e* and *f*.

There can be no question, however, that if the pipes were of earthenware, or if they were not in metallic communication at their junctions, that the instrument would, within the limits of resistance and currents above mentioned, be quite successful; and it has at least this merit under existing circumstances, that, so soon as a hole is dug and the covers of a connection box are removed so as to disconnect the iron tubing, the instrument will certainly indicate whether the periodic current in the main is passing that point or not; that is to say, whether the ground is passed or beyond, without disconnecting or touching the mains themselves. And since the needle can now be brought close to the wires, a very much smaller current and, consequently, a ground of very much higher resistance, can be detected than could be hoped for from the surface level. The result is that the labour and delay of soldering and unsoldering mains is in all cases avoided. In fact, although a specially made instrument has its advantages in swiftness and precision, any ordinary pocket compass will serve if a current passed and interrupted alternately every ten seconds be available through the main; so that, if at present the instrument cannot be made to give reliable indications from the surface above ground, it will at least prove a valuable adjunct to the means the workman has practically at command for removing grounds from mains.

Level Crossings.—An electric alarm for protecting the public using level crossings on railways has been devised by Mr. W. T. Folks. The best protection, however, is to abolish level crossings entirely.

ADELPHI THEATRE LIGHTING.

ON the occasion of the reopening of the Adelphi Theatre on the 19th inst., the house was for the first time entirely lighted by electricity, one more name being thus added to the steadily increasing list of places of public entertainment freed from the fearful risks of fire and panic. The air of the theatre during the performance was distinctly cooler and pleasanter, both for actors and audience; and it is, of course, anticipated that the elaborate and costly decorations will not need such frequent renovation as formerly. The number of lamps in the various parts of the building, including the bars, passages, refreshment rooms, auditorium, and stage, is about 1,500. The auditorium is lighted from the dome by means of eight 200 C.P. Edison-Swan lamps, ornamental 3-light brackets being suspended round the tiers, and single lights distributed about the pit, gallery, and boxes. Every precaution has been taken to secure absolute safety, both from fire and from the possible extinction of the lights, duplicate circuits being provided throughout.

The lamps for the floats, footlights, and battens are provided with collars of a special form, each carrying its own cut-out, and having extended terminals making contact directly with the main wires, which are completely enclosed in a slate casing, on which also the lamp sockets are mounted, proximity of any combustible insulating material to parts developing heat being thereby entirely avoided. All the other conductors about the stage are enclosed in wood casing, and are strongly insulated with India-rubber, and further protected by a sheathing of asbestos tube, and in all places where there is any liability to injury by violence or by nails being driven through the casing, a lining of sheet iron is provided. Lamps of high candle-power have been introduced in the construction of the variable resistances required for scenic effects. The engine room is in a building in Bull Inn Court, adjacent to the theatre, and though in a densely-populated locality, and built below the street-level, is spacious, lofty, and well ventilated. The plant consists of three 156 H.P. Babcock and Wilcox water-tube boilers, working at a pressure of 140 lbs., and four Willans double-centre valve compound high-speed engines (two of 75 indicated horse-power, and two of 130 I.H.P., coupled direct to four Edison-Hopkinson dynamos (two for an output of 105 volts and 800 ampères at about 425 revolutions, and two for an output of 105 volts and 475 ampères at about 475 revolutions). The armatures of these machines are of the bar type, and the magnets are exceedingly massive, those of the larger machine weighing nearly six tons. The four sets stand on one solid mass of concrete 6 feet thick, and there is a very marked absence of noise and vibration.

It is anticipated that a very economical result will be obtained, and already at a preliminary trial an electrical H.P., or 746 watts in the external circuit, was obtained from 30 lbs. of steam per hour with a return of 82 per cent. of the I.H.P. These results were obtained with comparatively wet steam, and as great precautions have been taken to supply dry steam, still better results should be obtained in practice.

The external circuits will be 12 in number, and two large distributing boards of slate, 6 feet 6 inches by 4 feet 6 inches, have been provided, the connections taking the form of large brass bars which can be coupled by means of plugs so as to make any number of combinations between the dynamos and circuits. In effecting changes, sparking is avoided by shunting the plugs through a quick break switch. The dynamos all work on independent circuits, and one dynamo is always held in reserve; and whenever it has to relieve another already at work, any dip in the lights is avoided by first of all bringing it up to full load on a resistance and then exchanging loads between the two dynamos by the reversal of a commutating switch.

It is Messrs. Gatti's intention in the course of a few weeks to entirely dispense with the gas service throughout the theatre so far as lighting is concerned, and they also contemplate supplying from this station the Adelaide Gallery, the Strand Restaurant, and probably also other buildings in the vicinity.

The installation is a credit both to the Messrs. Gatti, whose spirit of enterprise has led them to have everything of the very best, and also to the Edison and Swan Company which, under the able superintendence of its resident engineer, Mr. Blackburn, Assoc. M.I.C.E., has supplied one of the most perfect equipments we have had the pleasure of seeing.

UNDERGROUND ARC LIGHT CIRCUITS.

MR. B. E. SUNNY, president of the Chicago Arc Light and Power Company, has sent the following communication to the *Western Electrician*:—

"In a recent issue of an eastern electrical paper, under the head of "Those damp conduits," is published an interview with Prof. Henry Morton, of Stevens Institute, wherein he gives certain reasons why underground wires for arc circuits cannot be successfully operated.

"There is no subject upon which a man can feel more at liberty to express his views without risking contradiction than this one of underground wires, and in this case we would feel inclined to believe what the professor says, without questioning the accuracy, were it not for the wide discrepancy that exists between what he says is true and what we have found to be true. He says a moist conduit is utterly useless for carrying arc, and in some instances incandescent, currents, because there is no known insulation that will stand the effects of the moisture on the one hand and the tendency of the current to break through to the earth on the other. Further on he says that no satisfactory material has been found for the protection of insulation on underground wires. This is a severe arraignment of the several manufacturers of underground cables for arc currents, and no doubt those gentlemen can convince the professor that his statement is a trifle broad and considerably lacking in accuracy.

"We are working through 50 miles or more of lead cable in Chicago, all underground, and in a wet conduit, and are furnishing a satisfactory light service for 1,000 lamps. The lead cables contain an insulation $\frac{3}{16}$ths inch thick, and, while the cables of this type have been in service only about four months, we have so far not had one case of trouble in them. It is true that the lead cables put in in November and December last were burned out almost immediately upon being put into service, but this was not because the insulation was not suitably protected from the moisture of the conduit, but was entirely owing to the fact that the insulation of $\frac{3}{32}$nds inch was too thin. These cables had not been in service long enough to be impaired in the slightest by either gas or moisture, nor have the cables in use at present. It will no doubt take a long time to determine what the effect will be of the moisture and gas on the lead protection to the insulation, but we see no reason why there should be any, because of the fact that lead-covered telegraph and telephone cables have been lying in the same conduits for four years and are in a good state of preservation.

"The professor says, in support of his position, that in Philadelphia a mile or two of arc light wire was put underground but soon had to be abandoned. As he fails to furnish any particulars, it may be that he alludes to the circuit that we were told about at the Pittsburgh convention, which was not constructed according to the best ideas of underground work, and for the failure of which there were good reasons.

"D. R. Walker, chief of the electrical department of Philadelphia, says under the date of February, 1888: 'The Brush Company have been using underground cables on a 60-light circuit since the fall of 1885, the current passing through the cable 22 hours a day, and the daily test sheets show no deterioration." Evidently Prof Morton and Chief Walker are not in close communication on this subject, or else the latter has had some reverses in his underground experiences. Nor does the professor remember that Mr. Wilbur, of Girard College, has had an underground circuit of 2 miles, carrying 47 lights, in operation for a year without any trouble.

"To the statement made by the professor that it is only possible to run electric light wires underground for a short distance (this term may be taken to mean 1,000 feet), I would say that some of the Chicago circuits contain between 3 and 4 miles of wire, and there is practically no difference in the service furnished on the long and short circuits.

"The professor says that arc light wires would last for some time underground if provided with about *nine inches* of lead around the insulation. The lead around the Chicago cables is one-eighth of an inch thick, and the diameter of the entire cable is about three-fourths of an inch.

"Regarding the cause of the destruction of the lead cables that were used here in the early part of this year, we have no explanation that we can put forth with any degree of certainty. Many theories have been advanced, and among them are two that are worthy of consideration. The first is that when the dynamic current of 2,300 volts passes through the copper conductor, it generates static electricity in the lead covering around the insulation. Under ordinary circumstances the conduit, which is made of Dorsett material, is a good insulator, so that the lead is not connected with earth. When the lead becomes fully charged, the theory is that it discharges back into the copper conductor, puncturing the insulation at the point where the discharge occurs. Now a burn-out need not occur at the time of the puncturing, because the lead has no connection with the earth, and if the circuit is, aside from the puncture, in good shape, there is nothing to provoke a burn-out. When, however, the conditions in the conduit change, so that the lead becomes grounded by moisture in the ducts, or in the water in the man holes, a burn-out takes place at the point where the insulation was punctured. The second theory is that the belts on the dynamos generate a great quantity of static electricity, which finding no outlet to earth in the dynamo room is carried into the dynamos and out upon the circuits, where at some point in the lead cable it punctures the insulation and escapes to earth. Everyone familiar with the jumping propensities of static electricity will understand how this theory can be applied to the occurrences cited.

"As has been stated, the 'burn-outs' have all occurred in the cables of thin insulation ($\frac{3}{32}$nds inch), while none have taken place in the larger ones ($\frac{3}{16}$ths). Accepting either one of the theories as correct, the exemption from trouble in the cables now in use can be credited to the thick insulation entirely.

"While we do not take the position that we have solved the problem of working arc wires successfully underground, we do assume the position that it can be done, and that leaving out all of the instances of failure that were caused by construction palpably bad, there is more proof that it can be done than there is that it cannot be done.

"It cannot be denied that the proper place for a large number of arc light wires is underground, and that there is justice and reason in the complaints of the New York press against the condition of affairs in that great city. The numberless poles and the labyrinth of wires in the narrow and crowded streets, coupled with the semi-occasional report of some one severely injured, if not killed, make in themselves a commentary on the electrical genius of the chief city in the country that ought to be humiliating for any man or set of men to hear. The permanency and popularity of the service demand that it be carried on without imperiling the safety or convenience of anyone, and the attitude that seems to have been assumed in New York that no change can be made on present methods is not calculated to help the service in either respect.

"We are sorry for the encouragement that Prof. Morton gives to the anti-underground wire men, for the reason that the data to be had does not justify him in doing so, and because, though it be accurate or inaccurate, such a statement from such a source may help to put off the day when improvements ought to be made that are imperative, not only for the general good, but for the good of the arc light service."

ELECTRIC LIGHTING AT BATH.

IN our last issue we published the report of the electric lighting committee to the Bath Town Council, and the list of tenders for lighting a part of the city. The question has since been discussed at a meeting of the Corporation, when Mr. Sturges moved the adoption of the report and of the tender of Mr. Massingham, which, he pointed out, was the lowest, and would afford them the advantages of the Thomson-Houston system. The cost of lighting that part of the city in question by electricity would be £203 more than was now paid for gas; but, on the other hand, they would have eighteen or nineteen times more light. The men who were now endeavouring to bring about the introduction of the electric light into Bath were those who had already done so much to advance her interests. Alderman Oliver contended that the electric light was in its infancy, and it would be wrong to saddle the public with additional expense, combined with risk and uncertainty. At Taunton the cost of the electric light was said to be double that of gas, and in other places it had proved a failure. The danger of overhead wires ought also to be taken into consideration. Alderman Gibbs also objected, and eventually the discussion was adjourned.

The *Newcastle Chronicle* of the 25th inst. gives still later information to the following effect:—"Yesterday, by a large majority, the Town Council of Bath decided to light 50 of the principal streets of the ancient city by the aid of the subtle current. Probably the resolve is a judicious one. Bath is rapidly coming to the front again as a fashionable health resort, and money spent by the inhabitants in making it attractive is likely to be got back again with good interest."

Surely 50 streets must be a misprint for positions!

Comparing Very Unequal Capacities.—We have received a lengthy letter from Mr. J. Pigg on this subject, evoked by the communication of Profs. Ayrton and Perry which appeared in our last week's issue; it came to hand, however, a little too late for insertion in our current issue.

THE TRANSFORMER CASE.

Industries comments upon the Gaulard Gibbs *v.* Ferranti trial as follows:—"However much we may sympathise with Messrs. Gaulard and Gibbs, whose pioneering work in this direction has thus failed to obtain legal support, we cannot disguise the fact that, by breaking down the monopoly which they attempted to establish, Mr. Ferranti has rendered an enormous service to the electrical engineering profession at large, and the decision of Mr. Justice Kekewich is consequently received with satisfaction by the majority of electric light engineers. It might perhaps be urged that to give Messrs. Gaulard and Gibbs the exclusive right to transformer distribution need not necessarily retard the progress of electric lighting, for these patentees would find it to their own interest to grant licenses for the use of their system, and in fact have already granted such licenses for certain localities. It would obviously be impossible for the owners of the Gaulard and Gibbs patent themselves to carry out every installation in Great Britain which may be put down on their system; and to obtain the greatest benefit from the control of the patent they would naturally look to the granting of licenses, fixing their fees sufficiently low to induce the largest possible number of consulting engineers to recommend it, and contractors to carry it out. In theory such an argument is plausible enough; but in practice it is entirely fallacious. The fallacy lies in the assumption that one and the same system of distribution is equally applicable to all localities, and that in any one locality only one system need be adopted. The great object of a company starting an electric light station is to earn money by the sale of electrical energy, and to attain this object they must be prepared to supply this energy in exactly that form or variety of forms demanded by their customers. An electric light company should not restrict itself to one particular system; it should, if the demand is sufficiently great, be prepared to supply electricity in any form, whether by the direct low tension system, the direct high tension arc light system, by accumulators, or by alternate current transformers. All these systems are useful in certain cases, and to restrict the choice of system in any way is equivalent to curtailing the earning power of the station. If Messrs. Gaulard and Gibbs had a monopoly of distribution by transformers they would have to parcel out Great Britain into districts, to be taken up and worked under license by different electric lighting companies. There would be endless complications about overlapping of districts and want of coincidence between the boundary as defined by the Gaulard and Gibbs licence and that imposed by municipal and other local considerations. The consulting engineer, when advising his clients whether to adopt the Gaulard and Gibbs system or not, would have to consider a variety of points quite foreign to the scientific and technical parts of the problem, and to escape from incurring responsibility in matters outside his professional control, would, in most cases, advise to leave the monopolised system alone, and adopt one in which his hands would be free to do the best he can for his clients. We may, therefore, set aside the argument that a monopoly in distribution by transformers would not necessarily restrict the development of central station lighting.

"On the other hand, we doubt very much whether the loss of their patent will in reality prove disadvantageous even to Messrs. Gaulard and Gibbs themselves. To them undoubedly belongs the merit of having been the first to show distribution by transformers in practical operation in England, and this fact cannot fail to invest their company with a considerable amount of prestige. There will be no lack of work for a company who is so favourably situated, and it is quite possible that by doing this work the company will fare better than if they had succeeded in establishing their monopoly."

After reading the above we can almost imagine the proprietors of what used to be the Gaulard-Gibbs patent smacking their lips with satisfaction at the result of the action. The time appears to be fast coming when, under the subduing influence of the peaceful *Industries*, the lion and the lamb will lie down together; but, as the Yankee said, it will be with the lamb inside the lion.

SCIENCE AT THE TEMPLE.

On Thursday, July 19th, the Treasurer and Masters of the Bench of the Inner Temple gave an "At home" in the above building to their friends. The great hall, library, and adjoining offices were used to accommodate the guests, who numbered, in spite of the unseasonable weather, nearly 400. It was really a scientific "At home," for Mr. A. R. Sennett, A.M.I.C.E., who had undertaken the task of planning and arranging the programme of the evening, brought together a vast collection of apparatus, scientific and artistic.

Taking, for instance, the branch of telegraphy; within the space of a few yards it was possible to transmit or receive submarine, overland, and aeronautic messages, so it will be seen that the arrangements were of rare order and complete in every detail.

The exhibits may be divided into two classes: the one consisting of the more delicate apparatus, such as telegraph instruments, siphon recorders, telephones, &c., being arranged in the large hall and its annexes, and the other, comprising dynamos, engines, search lights, &c., shown in a large marquee erected for the occasion between the hall and the lecture room. Communication between these two buildings (in the latter of which Dr. Tyndall's rainbow experiment was shown) had been arranged by means of an artificial submarine line, having attached a mirror instrument at the lecture room end, and a siphon recorder at the end in the great hall.

In the marquee a Crompton search lamp of 25,000 C.P. Admiralty type, was exhibited by Messrs. Crompton & Co., who likewise showed a gigantic switchboard in the vestibule, and supplied the main portion of the lighting plant for the occasion.

In the marquee also was a Willans central valve engine for direct driving of dynamos, and the Nordenfelt Company's new electric torpedo, which does not require an ejecting tube or gun. Several quick firing machine guns were exhibited by Messrs. Maxim and others.

The illumination of the Great Hall itself was of a novel character, and was devised by Mr. Sennett. 22 arc lamps, each of 3,000 C.P., were suspended outside the stained glass windows, and by this means the interior was lighted in a subdued yet perfect manner. A few shaded lamps placed here and there among the exhibits only served to make the electric light more conspicuous, and here were exhibited most of the modern appliances of telegraphy, telephony, &c. By the kindness of the Postmaster General, a complete set of transmitting and receiving instruments was placed in communication with Manchester, and the instruments themselves worked by trained operators. Messrs. Elliott Bros., in whose collection of apparatus, Sir William Thomson's measuring instruments were included, among other objects exhibited a Boulengé chronograph of the newest pattern, and an improved calculating machine working sums up to 16 figures with marvellous accuracy. A Sir William Thomson's siphon recorder with Varley's artificial cable, lent by the Hanover Square School, attracted much attention. The recorder was in communication with a mirror instrument in an adjoining room, where Mr. Lant Carpenter explained the working of both instruments at intervals. The siphon recorder in connection with the lecture room before mentioned was of later pattern, designed by Mr. Dickenson, and constructed with horizontal permanent horseshoe magnets in the place of electro-magnets, and a mechanical vibrator to discharge the ink on to the paper in the place of the mouse mill. This system has undoubtedly the advantage of greater portability, and does not require powerful batteries to excite the electro-magnets. Messrs. Sennett, Schanschieff, and the Edison and Swan Company exhibited portable electric lamps of various patterns, and cables of all sorts and in all stages of manufacture were there also.

The Exchange Telegraph Company's type-printing instruments recorded at intervals Parliamentary and other news from the outside world, and Mr. Robertson's writing telegraph added to the general interest.

The centre of the hall was occupied by an immense Wimshurst influence machine which was set in motion late in the evening, treating the onlookers to mimic lightning flashes; and two balloons, which exemplified practically the method of signalling in time of war.

For those of the guests who appreciated music, telephones in connection with the Savoy Theatre were at hand in great number, and portions of the "Mikado," the solos especially, were heard very distinctly, public applause sounding to the listener somewhat like small shot being dropped on the transmitter diaphragm.

In the Robing Chamber the microphone and induction balance of Prof. Hughes were on view, and on entering the Parliament Chamber Mr. Sennett's ingenuity in the way of decorative lighting was again manifest. The centre of the room contained a sheet of water, represented by mirrors, with verdure overhanging, from which depended incandescent lamps. The whole of the current used for lighting this chamber was supplied by accumulators, kindly lent by the E.P.S. Company. In the library, where refreshments were served, a phonograph was on view, and it was here that Mr. C. V. Boys, F.R.S., illustrated his beautiful experiments with soap bubbles, and attracted much attention to them by his clever manipulation, all the details connected with these experiments being clearly shown on a screen with the aid of the electric light.

There were exhibited many other miscellaneous objects connected with photography, gas-making, boat-building, &c., but space will not permit of their enumeration. It may be mentioned here that during the evening an excellent selection of music was given in the Great Hall, and, judging by the remarks made, the treasurer and masters must have felt gratified at the undoubted success of their "Scientific at Home," and Mr. Sennett, as the head of the executive, deserved the warmest praise for his arrangement of the scientific and musical portion.

SMALL ELECTRIC MOTORS.

IT is admittedly difficult to produce very small dynamos or motors of a character to compete at all as regards satisfactory working and efficiency with larger machines, partly because the laws of construction, which are now pretty well understood, do not altogether apply when dealing with very small dimensions; and partly because where they do apply it is not practicable to carry them into effect within the limits of cost imposed by the necessities of the case. For instance, one of the conditions to be observed in reducing the sparking at the commutator is the division of the armature winding into a great number of sections, and in ordinary machines 80 or 100 commutator bars is quite an ordinary number. The necessity for such a subdivision is as great in a very small machine as in a very large one, but it is both practically and commercially impossible to carry out such a construction in the former case. We have always been of opinion that, if there is any difference between them, small machines should be made to work better than large ones, for the reason that while it is no great drawback to provide an attendant to look after a large and important machine, it is a very great drawback to a small and unimportant machine if it requires any considerable amount of attention. If the young lady whose sewing machine is being driven by an electric motor has to interrupt her work at frequent intervals for the purpose of oiling the bearings, setting the brushes, or filing up the commutator, one cannot wonder if she discards the scientific but troublesome motive apparatus and falls back upon that with which a kind nature has provided her. Although in this country there is unfortunately no pressing demand for electric motors, either large or small, we are convinced that before long there will be a change for the better in this respect, and we therefore urge the subject upon the attention of our readers.

We have been led to these reflections by noticing in a recent number of our contemporary, *The Electrical World* of New York, a description of a motor apparently of small size, the invention of Dr. Lugo. In America there seems to be no adequate response to the demand for small motors. An examination of those most extensively advertised, and, we presume, most largely used, shows that, so far, sound principles of construction have not yet been applied to the smaller sizes of motors, and some of the reasons we have indicated. But we think that there is not wanting evidence pointing to the belief that the men who have designed successful large motors, or who have laid down the principles on which they should be constructed, have not given their attention to small machines, the majority of which bear the mark of the 'prentice hand, and of the 'prentice hand only.

We fear that this latest candidate for recognition and use, to which we have just alluded, is no better than some of its predecessors. It bears the appearance of having been made from a number of electro-magnets taken from obsolete telegraph relays or "Bright's bells." Four of these magnets form the armature, and five the field, using these words as indicating respectively the rotating and the stationary parts of the machine. This arrangement of an unequal number of magnets is not new, but it is carried out in this little motor with the assistance of two commutators (*one* is usually one too many), one for the armature, the other for the field, the electromagnets of the field being commutated and even cut out of the circuit periodically, in the same manner as those which form the armature. When we add that there is no lamination of the iron, and that it is claimed that the power due to the attraction of the pole-pieces is added to that due to the parallelism of the windings, it will be understood that, however much it may be regretted, we are not in this matter furnished with the opportunity for chronicling an advance.

NOTES.

The Electric Lighting of a Colliery.—The Simplex Electric Light and Plant Company, Limited, *v.* Cooper and Craig.—Mr. Bigham, Q.C., and Mr. Hopkinson for the plaintiff; Mr. Gully, Q.C., M.P., Mr. Yates, and Mr. Brierley for the defendants. This was an action to recover the agreed price of installing the electric light at the colliery of the defendants in Staffordshire. £100 had been paid on account. There was also a set-off and counter claim. The Judge said he thought the parties would get greater satisfaction from someone having special knowledge. Mr. Bingham said he was not in a position to teach his lordship anything about the subject. He thought they ought to leave it to some practical engineer. The Judge said there was a great deal of mere account. There was also a great deal of curious and no doubt interesting special matter, and in addition to that, the question of damages, involving matters of intricacy. He did not like to shrink from any duty that came to him, but he thought it was a case that should be referred, or, better still, they might agree to a settlement. After some discussion Mr. Gully said they had agreed to refer the matter to someone to be agreed upon between the parties.

Electric Lighting on Board a Royal Yacht.—The installation of the electric light on board the Royal yacht *Osborne*, commander the Hon. Hedworth Lambton, at Portsmouth, has now been completed, the work having been carried out by the dockyard staff of electricians. As it has been found that the solitary dynamo which was supplied is inadequate for the requirements of the whole system, it has consequently been decided that for the present the electric light must only be used for the Royal apartments and the officers' cabins, &c. Later on another dynamo will be provided, and the boon of the electric light afforded the lower decks.

Electric Lighting in New Zealand.—The City Council of Wellington has accepted the tender of the Gülcher Electric Light Company, of London, for machinery, buildings and plant for lighting the city with 480 Edison-Swan lamps, each of 20 candle-power. The contract price is £1,750 per annum for the first five years, and an offer was made to run on for another five years at £1,600 per annum, should the council not decide to purchase the plant at the end of the first period. The Gülcher Company was, we are informed, the only one tendering, although the matter was freely advertised in England, America and, we believe, on the Continent.

Ship Lighting.—The daily papers have for the past few days been quite full of the wonderful decorations of the Inman liner, *City of New York*, and from all accounts she is probably the most lavishly got up vessel afloat. The electric lighting of the ship is safegnarded by the duplicating of the generating power. Four sets of engines by Messrs. King, Brown & Co., Edinburgh, are provided, situated on a platform in the engine-room above the level of the main engines. There are in all about 1,000 incandescent lamps, those for the passengers being of 16 candle-power. There are also 30 of larger type for cargo-working purposes. On the bridge, which is immediately in front of the forward funnel and extends from side to side of the ship, is situated a powerful search electric light, similar to those fitted on war ships, capable of reflecting a brilliant ray, sufficiently clear to enable the operator to discern a small object a couple of miles away. This is used at night, amongst other things, for finding the buoys on entering channels at the end of a voyage. Electricity is also made available for actuating some of the ventilators.

The Lighting of Barnet.—Messrs. Henry F. Joel & Co. inform us that it has been decided to use 32 C.P. lamps for the Barnet lighting, and that overhead conductors will run from post to post except at road crossings, where underground cable will be used. It was first proposed to use 16 C.P. lamps, which have been shown in several instances to be quite unsuitable for street lighting, and we shall probably now see what can be done with lights of double that power, unless a fresh decision should suddenly stipulate that 50-candle lamps be used. We doubt very much the advisability of the contractor being also the technical adviser to the Barnet Local Board.

Electric Lighting in War.—In connection with the proposed erection of a battery at Gourock for the defences of the Clyde it is said that the Government contemplates the installation of two powerful electric search lights, about 300 yards west of Kempoch Point.

Lighting the Brighton Jubilee Clock Tower.—The Gas Committee of the Brighton Town Council, on the 9th inst., read a letter from the Brighton Electric Light Company, Limited, offering to light by electricity the Jubilee Clock Tower, North Street Quadrant, from dusk till 11 o'clock p.m. during the three months ending September 30th for the sum of £20, and it was resolved that the Electric Light Company be informed that the Committee deem it unadvisable to accept their offer, and that the company be requested to remove the lamps now attached to the Tower.

Ball Room Lighting.—*Truth* of Wednesday says :—"Madame de Falbe's ball last Tuesday to the Duchess of Teck was one of the best of the season. It was brilliant, brisk, and very smart. The electric light has been introduced since last year, which is a decided improvement, as it showed off the superb decorations with great effect."

Long Distance Telephony.—The Western Counties and South Wales Telephone Company is about to give another proof of its enterprsise by establishing trunk lines between Southampton, Bournemouth, Gosport, Winchester, Bishopstoke, and Portsmouth, thus supplying a want which has been long felt in Hampshire. The minor details have not yet been decided upon, but with the assistance of the public it is hoped to effect this desirable extension within a short space of time. The company is also engaged in bringing Kingsbridge and Salcombe into telephonic communication, the residences of Dr. Webb and Dr. Twining, who are partners and live respectively at the places mentioned, being connected by a private wire, a route of about six miles having to be traversed.

Telegraphic Communication with Mauritius.—Sir E. Watkin recently asked the Under Secretary for the Colonies, whether the island of Mauritius, which had a naval dockyard, and the fortified harbour of St. Louis was, like Bermuda, unconnected by submarine telegraphic cable, independent of foreign interference, with any other portion of the Empire; whether the Malagasy Government so long as three months ago expressed their readiness to assist in establishing direct communication through their territory with Great Britain by means of a cable from Mozambique, to be landed at Mojunga, and by the erection of a land line thence to the capital, and onwards to the east coast at Andevoranto, or Vatomandry, with the right to connect the same by cable to Mauritius; and whether he had come to any decision in the matter. Sir. J. Gorst, for Baron H. De Worms, said :—There is no direct telegraphic communication with Mauritius, but messages are sent as opportunity offers by steam vessels from Aden, Natal, and Australia. The particular proposal referred to has not come under the consideration of Her Majesty's Government, but various schemes for laying a cable to Mauritius *viâ* Madagascar have been and still are under consideration. It has not, however, been found possible to make provision for this service, and until arrangements can be made for meeting the cost of a cable, it is not possible to come to a decision as to the particular route.

Electric Night Signals for Use at Sea.—The system of signals by incandescent electric lights as recently adopted in the German and Italian navies was exhibited by Lieutenant W. H. Beehler, United States Navy, on board the United States steamer *Atlanta*, at Annapolis, recently, during the graduating exercises. Fourteen combinations are possible.

Chicago Underground Scheme.—The last proposition for the solution of rapid transit in Chicago is of gigantic proportions. A company has been incorporated for the construction of an underground railroad, similar to the network which stretches in all directions under the streets of London. The novel feature of this project, the *Western Electrician* states, is the proposed employment of electric motors and of electric lights, thus removing the objections to the Metropolitan railway of London. The plan is bold enough to challenge admiration, and while many doubt its practicability until Chicago has a population of a million and more, it strikes others, whose opinions are entitled to weight, as a perfectly feasible project. That the engineering problems could be solved there is little doubt. The great question will be whether the road would obtain patronage enough to pay interest on the enormous investment which would be required.

The Dangers of Railway Travelling.—Many of our readers have doubtless perused the experiences of "Pro Bono Publico" which he sent the *Standard* of Tuesday last, descriptive of an unpleasant journey from London to Liverpool on the London and North Western Railway. Several correspondents followed up the matter the next day, and showed that his experience was not unique. But the point to which we wish to direct attention is the extract below from the first letter, followed by another from a communication signed "North Western":—

> "About half-an-hour out of Rugby things were becoming so critical (the fright of the lady and children being so acute and painful to witness) that I pulled at the communication cord, but it would not act on our side, and I could not get past the combatants to try the other side; in fact, I employed about ten minutes in a fruitless pull at the cord, the only result being that it simply came away in my hand. It was not connected, and this was an express train, and non-stopping, too."
>
> "There is no blame attachable to the London and North Western Railway on account of 'P. B. P.'s' inability to communicate with the driver and guards. He was evidently on the near side of the compartment, whereas the communication cord, as stated in the directions exposed in every compartment, was attached to the off or right-hand side of the carriage, access to which was prevented by his inebriated fellow passengers."

Now why, in the name of common sense, is not the means of communication between passenger and guard placed so as to be available from any part of the carriage, and under any conditions when a man has the use of his hands, and, as it is well known that cords are never to be depended upon, why is not this communication made electrically? The sooner all our railway companies look to this the better for them and for the travelling public, and the London and North Western Company might do worse than to follow the example of the South Eastern, the Brighton, the London, Chatham and Dover, and the Hull and Barnsley lines, where the electrical system is wholly, or partially, adopted as the only reliable one.

What Will They Do With It?—*Money* says:—"Now that the worshippers of that Fetish, the electric light, have got what they wanted—an amendment of the Act of 1882—it remains to be seen what they will do with it. Echo answers, 'Do with it.' One thing is tolerably certain—it will cause an influxion of new electric light companies, and prove a boon to the company promoters, if to no one else. All the same, the gas companies and the proprietors of gas stocks can afford to smile at the puny efforts of the electric light apostles." Before the end of the present decade we will venture to say that *Money* will be in it.

The London Chamber of Commerce Electrical Section.—We would remind our readers of the meeting which takes place to-day at Botolph House, at 3 o'clock, for the purpose of forming an electrical section to the London Chamber of Commerce. The fullest discussion is invited, and if it is considered desirable to form the section, resolutions in that sense will be submitted and its organisation proceeded with. The views we hold in connection with this subject are already known to our readers, and we need only repeat that the movement has our entire approval. Its significance to the electrical trades is made apparent when we say that the Chairman of the section is entitled to a seat on the Council of the Chamber, and that any action which may be taken in the interests of the electrical industry would be in the name of the Chamber itself. About one hundred gentlemen connected with the electrical and allied trades are already members of the Chamber, so it should not prove an overwhelming task to form a section really representative of these industries.

The Paris Exhibition of 1889.—The Lord Mayor entertained on Saturday night at the Mansion House the Executive Council of the British Section of the Paris Exhibition, 1889. Amongst those present were the French Ambassador (M. Waddington); M. Georges Berger (Director-General of the Paris Exhibition); Sir Daniel Cooper; Sir Frederick Abel, F.R.S.; Mr. E. Graves (President of the Society of Telegraph-Engineers); Mr. W. H. Preece, F.R.S.; Major-General Webber; Professor Dewar, F.R.S.; Mr. W. Crookes, F.R.S., &c. English exhibits, as a whole, will be a full representation of the manufactures of the country, but those representing the industries in which we are especially interested will be very meagre and incomplete. Many of our largest firms are holding aloof, although we understand that appeals, both personal and otherwise, have been made to them by various representatives of the Paris Exhibition Executive Committee and by the Society of Telegraph Engineers and Electricians. It is presumed that the feeling generally is that exhibitions do not pay. We may be told that French tariffs practically exclude many articles of English manufacture, but in cases of this kind sometimes the benefits accrue long after the effort has been made; and an exhibition in Paris does not mean an exhibition only to Frenchmen, but to the world. We trust that even yet it is not too late to find some of our leading firms avail themselves of the saving clause by which the Lord Mayor held that, although the present space was fully appropriated, yet some extra room might be found for exhibits of a specially interesting character that might come in at the eleventh hour.

An Idea.—In New Zealand there are upwards of 2,000 telephones at work, or an average of one telephone to every 100 people in the areas served. At the same rate London would require just ten times the number of instruments presently in use. The Sandwich Islands, however, can beat even the New Zealand record. Now, here, says the *Financial News*, is an idea for the United Telephone Company. In order to see how it is done let Mr. Morgan, the managing director, go, say, to the Antipodes first and to Honolulu afterwards. Travelling expenses would cost the company less than his weekly journeys to Liverpool and back, which evidently lead to no improvement. While he was gone ample reforms might have a fair trial, and on his return the new ideas he had picked up might be of value.

Electric Traction in Australia.—Messrs. Booth, Ellson & Co., electric tramway engineers, of 5, Queen Street, Melbourne, Australia, have secured the right of tramways for the city of Sandhurst for the term of 30 years. A large company has been floated by them to carry out the work, and Mr. Ellson (formerly with the Hammond Company of England) is now on his way to this country to make the necessary arrangements for plant, &c. These people have similar schemes on hand for several other towns in the colonies. Once introduced we expect to see as rapid an extension in Australia as has lately taken place in America in this direction. We wish Messrs. B., E. & Co. every success in their undertaking. All letters to Mr. Ellson should be addressed to General Post Office, London.

The Weston Patents.—In reply to a query from us, the following information has reached this office just as we go to press:—"As to the statement which appeared in the *Standard* a few mornings ago, about Weston's priority of invention to both Edison and Cheesbrough (Sawyer-Man) in U.S.A., Weston's patents in *this* country, both for incandescence lamp details, such as his 'tamadine' filament material, as well as for flashing in hydro-carbons, are *subsequent* to Cheesbrough, Edison of 1879, and Swan's and Lane-Fox's patents of 1880. In fact, Weston did not patent in this direction in *this* country until 1882, though his American patents show him to have been at the subject years before. He was working at carburetting lighting gas contemporaneously with Maxim and Sawyer in 1877, 1878.

Difficult to say.—A correspondent writes to ask if Swan's patent for "running on the pumps" will not of itself give the Edison-Swan a monopoly, as Mr. Justice Kay said it is always done. It is difficult to answer this question. The Edison-Swan Company sued Woodhouse and Rawson on this patent, but withdrew it, and there is now some doubt as to its validity. Edison in an earlier patent describes his process of freeing platinum wire from occluded gases, and mentions that carbon sticks may be treated in the same way. We doubt if this is really a publication. We think, however, that "running on the pumps" may be held a colourable imitation of the process covered by the last claim of Cheesbrough. Whether anything can be made of this remains to be seen. Nothing has been said about it in any of the actions.

Another Anticipation.—A correspondent writing to *The Banner* of the 20th inst., sends the following:—"I have been interested in a volume of *Punch* of the year 1849 to read a piece of fun called "Music by Electric Telegraph," and referring apparently to an attempt to send vocal messages in this way. It suggests that our great singers should quadruple their gains by having wires laid to different cities. Surely Mr. Edison's invention is not forty years old? Yet here is the idea in this *Punch* of 1849.

Australia Alive to the Situation.—The Finance Committee of the City Council of Sydney, at its meeting on the 17th May last, passed the following resolution:—"That the city solicitor be instructed to advise the council whether they have power to lay down and establish a system of electric lighting, and that Messrs. Ganz & Co. be informed that this council will be prepared to call for tenders to light up a section of the city. That permission be given to Messrs. Ganz & Co. to exhibit their light in any place to be approved of by his Worship the Mayor."

The Zipernowski System.—We are informed that the application of the system of distributing electricity with the Zipernowski-Déri-Blathy transformer is now rapidly increasing both at home and abroad. In Melbourne a group of very strong capitalists has just formed a company for establishing electric lighting plant and especially large central stations, with dynamos, transformers, and apparatus manufactured and furnished by Messrs. Ganz & Co., of Budapest. The company has already ordered the complete material for the following Australian plants:—(1) For a central station to be established in Melbourne with a capacity of 2,700 H.P., to be increased later to double that capacity; (2) for a central station in Huntershill (near Melbourne) with a capacity of 450 H.P.; and (3) for a central station in Huntershill (near Sydney) with a capacity of 450 H.P. Messrs. Ganz & Co. have lately also received another important order from Montevideo, where the already existing central station is to be increased by 750 H.P. The fact that all these plants have been ordered, after most satisfactory experiences made with smaller installations, may be taken as a proof of the advantages and practical efficiency of this system. Messrs. Ganz & Co. have also to furnish the necessary dynamos for a large central station to be established in Valencia, and for the transmission of power in Rives (France).

Struck by Lightning.—A correspondent signing himself "Electron" has written to a provincial contemporary touching the accident which happened to a man near Reading, reported in our columns of last week. His opinion of the case is as follows:—"I should imagine that, from the description given of the affair, that the man was positively struck by a flash of lightning; his clothes being torn, and himself injured, prove the case. He having an iron hook in his hand at the time made no difference one way or the other, as is erroneously supposed. He was accidentally in the line of discharge, and received the current, and was fortunate to escape with his life."

Refining Sugar by Electricity.—It is rumoured that the invention of a Professor Henry C. Friend, of America, is likely to entirely revolutionise the present process of sugar refining, by the employment of electricity. As the Professor has recently departed this life and as his process is known only to his widow, we fear that the value of the invention must be discounted as there is a deal of mystery attached to the whole business. A friend in need is a friend indeed, but perhaps the sugar refining industry does not require any assistance.

Electricity Cures Roaring.—Mr. T. G. Parr, V.S., writes to the *Field* to say that his experience goes to prove that electricity may be successfully applied as a means of curing roaring in horses, and he strongly advises both veterinary surgeons and owners of the noble quadruped to give it a trial. We hope our advice will not be asked as to whether the course of treatment will infringe the "electropathic" system claimed by C. B. Harness, for we have not yet been able to arrive at a satisfactory decision about that sparrow on the housetop, whose cure Mr. Browne so eloquently dilates upon in our correspondence columns.

Telegraphic Address.—The Electric Apparatus Company of 4, Charing Cross, have registered as their telegraphic address "Campanile, London."

Exeter City Lighting.—Tenders will be received up to 22nd September by Mr. B. C. Gidley, Town Clerk, for lighting with arc lamps a certain area of the city for an absolute term of seven years. Plans and conditions can be obtained of the City Surveyor, Exeter.

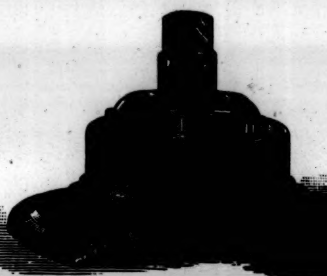
Electrical Workmen's Club.—We are informed that a meeting of electrical workmen will be held at the New Bridge House, Lambeth Walk, on Sunday evening, August 12th, to elect a committee to frame rules, &c., for a new club. We also learn that several employers seem to regard the movement with favour.

The Coming Electric Light Boom.—Under this title the *Financial News* of yesterday devoted considerable space to show that the electric light is on the eve of a happy resurrection. The basis of the article appears to be the prospects which are in store for the "powerful financial combination" which is about to operate in the neighbourhood of Whitehall, Lincoln's Inn Fields, St. James's, Westminster, and St. Martin's-in-the-Fields. The commercial gentlemen whose names figure in the scheme include those of Sir John Pender, Sir James Anderson, Admiral Richards, Sir George Elliott, and Sir Robert Fowler; whilst electrical engineering is represented in the persons of Sir William Thomson, Dr. Hopkinson, and Mr. J. E. H. Gordon, the new convert to the belief in accumulators.

The Coal Bill.—At the last half-yearly meeting of the India-rubber, Gutta-percha and Telegraph Works Company, Limited, "the managing director stated that the price and the quality of coal always had his personal attention." We wish that every managing director could with truth say the same. To enable us to judge of the questions asked by Mr. Webber, and the statements made by Mr. Gray, we are sorry that no prices for coal were mentioned, that is to say if Mr. Gray will inform us what price he is paying for coal, and Mr. Webber will say at what price he has offered them, we shall be able to get a better idea of the point at issue. Perhaps Mr. Webber will also tell us if he supplies coal to other similar companies, and if so, at what price.

Central Station Requirements.—Now that the electrical atmosphere is filled with floating rumours of big enterprises in central station lighting, there should be a good time coming for wire manufacturers. Underground conductors will doubtless have the pull, and we shall shortly hope to see great activity in this branch of business. The manufacturers also of steam engines, especially for electric lighting purposes, will doubtless increase and multiply as central stations develop.

Double Pole Instantaneous Break Switch.—This switch, which is one of the latest of Messrs. Woodhouse and Rawson's numerous designs for electric light switches, consists of two multiple contact brushes, one beneath and one above a circular slate block, both being fixed to the same centre pin, but insulated from one another, and actuated by the same thumb tap. This latter is loosely carried by a centre stud, and has two pins working in segmental slots, which allow the brushes to fly off the contact plates the moment their friction is overcome by the two multiple steel springs shown in the engraving, independently of the thumb tap itself. The switch is enclosed in a neat spun brass cover and mounted on a base of fancy wood.



A "Midsummer Night's Dream."—Mr. Labouchere entertained his friends at his residence, Pope's Villa, Twickenham, one evening last week, with an outdoor performance of Shakespeare's "Midsummer Night's Dream," wedded to Mendelssohn's delightful music. Of course electric lighting was very much to the fore, and this is a graphic description, taken from the *Glasgow Herald*, of the vagaries of the demon arc lamps :—"A curious result of the dampness of the surroundings was that the electric lights gave off what were practically minute flashes of lightning, which darted through the air among the crowds of performers, who remained all unconscious of the peril in which they stood, regarding the miniature lightning as some ordinary 'gasman's' effect, 'done on purpose to heighten the charm of the woodland scene.'" Those who experienced the pleasure of being Mr. Labouchere's guests must have had thrilling stories of hairbreadth escapes to relate to their less fortunate friends and relations.

To all Whom it may Concern.—In the report of Mr. Justice Kay's judgment in the case of "Edison and Swan United Electric Light Company, Limited *v.* Holland and Others" (the *Times*, July 17th, and "The *Times* Law Reports," vol. 4, p. 688) the word "not" should be substituted for "but" in the following sentence :—"Suppose the claim had been thus worded —'I have succeeded in making an electric lamp with a carbon burner, say $\frac{1}{100}$th of an inch in diameter, which gives a high resistance, and I claim a monopoly of all lamps with carbon burners *but* thicker than that, however made.'"

The Lowrie-Hall System.—Messrs. Hammond & Co. inform us that they have recently received a large order to supply the requisite plant, on the Lowrie-Hall system, for a central electric lighting station in America. This is, indeed, satisfactory news.

Electric Light at Ilfracombe.—A special meeting of the Local Board was held on Saturday to consider the question of lighting the Victoria Promenade. A letter was read from Mr. Woodley, with whom the board has been in correspondence relative to the introduction of the electric light, offering to light the Promenade for £150 for the first year if the Board would pay £60 if the fittings had to be taken away, or he would light the whole town for £680 per annum. It was finally resolved that the board would accept Mr. Woodley's terms to light the Promenade for one year. The surveyor was also instructed to ascertain the costs of lighting the Parade with electricity, and on the terms being ascertained to submit them to a meeting of the board.

Simple Magneto Bells.—Mr. E. Cox-Walker and Mr. A. A. Campbell Swinton have designed a novel system of magneto-electric bells of great simplicity, suitable for domestic and similar purposes. These bells will very shortly be introduced to public notice through the agency of the Equitable Telephone Association, Limited.

Quien Sabe ?—A friend writes :—"Will Mr. J. E. H. Gordon succeed better with the electric lighting schemes which he has now in hand with the support of prominent members of the 'Cable ring' than with the wild notions which were fostered and for a time cherished by the T. C. and M. Company ?" Probably he will ; but as we say at the beginning, *Quien sabe ?*

NEW COMPANIES REGISTERED.

Union Agency, Limited.—Capital : £12,000 in £10 shares. Objects : To acquire, establish, maintain, carry on, and dispose of railways, telegraphs, electric lighting and gas works, telephones, and other property. Signatories : J. V. Russovich, Falmouth ; W. J. Thomas, 6, Montagu Villas, Wood Green ; H. Plumbly, 4, Pepys Road, New Cross, 50 shares each ; D. Macfie, 4, Hanover Square, 250 shares ; A. Parmenter, 57, Dynever Road, Stoke Newington ; C. J. Otway, 140, St. Thomas Road, Finsbury Park ; H. Barclay, 6, St. Helen's Terrace, Hastings, 1 share each. Directing qualification : £500 in shares or stock. Remuneration : £500 per annum, and a further sum not exceeding £500 out of the surplus of the net profits after 7 per cent. dividend has been paid on the ordinary shares. Registered 23rd inst. by J. V. Musgrave, 44, Gresham Street. Registered office, 3, Copthall Buildings.

Eagle Iron and Engineering Company, Limited.—Capital : £6,000 in £5 shares. Objects : To carry on business as iron and brass founders, engineers, boiler makers, and makers of electrical appliances. Signatories (with 1 share each) : *J. J. Smith, Watford ; *C. J. Bill, 19, Chepstow Villas, Bayswater ; J. S. Hepburn, 76, Cheapside ; B. Cooper (engineer), Eaton Road, Coventry ; A. S. Tomson, 15, Union Street, Coventry ; *T. Elliot, 12, Gloucester Street, Coventry ; J. M. Dale, Radford, Coventry. Directing qualification : £100 in share capital. The first ordinary directors are the signatories denoted by an asterisk, and Mr. A. Donan. The company in general meeting will fix the remuneration of the board. Messrs. Thomas Elliot and Bernard C. Smith are appointed managing directors for two years, at salaries of £200 per annum each ; they will also be entitled to 25 per cent. of the annual profits beyond sufficient for 5 per cent. dividend. Registered 24th inst. by Hepburn, Son and Cutcliff, Bird-in-Hand Court, 76, Cheapside.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Macmahon's Electric Automatic Registering Company, Limited.—The statutory return of this company, made up to the 5th inst., was filed on the 16th inst. The nominal capital is £20,000 in £1 shares. 500 shares are taken up and 8s. per share has been called and paid thereon, the paid up capital thus being £200. Office, 53, Coleman Street.

Electrical Works Construction and Maintenance Company, Limited.—The statutory return of this company, made up to the 28th ult., was filed on the 16th inst. The nominal capital is £2,000 in £1 shares. The only shares taken up are the seven subscribed for by the signatories to the memorandum of association, and upon these no call has been made. The return is filed by Mr. G. A. Grindle, of 19, Great Winchester Street.

Schanschieff Electric Battery Syndicate, Limited.—At a meeting of this syndicate, held on the 9th inst., a resolution was passed authorising the increase of the nominal capital of £30,000 by the addition thereto of £10,000 in 40 shares of £250 each. In conformity with the requirements of the Companies Act a notification of this increase was duly registered on the 19th inst.

South Metropolitan Electric Supply Company, Limited.—The statutory return of this company, made up to the 5th April, was filed on the 19th inst. The nominal capital is £250,000 in £10 shares, but the only shares issued are the seven subscribed for by the subscribers to memorandum of association, upon which no call has been made. Registered office, 169, Winchester House, Old Broad Street.

At an extraordinary general meeting held at 23, Great George Street, Westminster, on the 5th inst., resolutions were passed authorising the increase of the capital to £500,000 in £10 shares; articles of association were adopted in lieu of existing regulations, and the name of the company was changed to the Metropolitan Electric Supply Company, Limited. These special resolutions were confirmed on the 20th inst., and were duly registered on the same day. The directors appointed under the said articles are Sir John Pender, Sir George Elliott, Bart, M.P., Sir James Anderson, J. S. Balfour, J. E. H. Gordon, J. C. Parkinson, J. D. Pender, J. B. Verity, and H. G. Wright. The Board of Trade has signified its approval of the change of name adopted by the company.

Southampton Electric Light and Power Company, Limited.—The registered office of this company is now situate at 23, High Street, Southampton.

CITY NOTES, REPORTS, MEETINGS, &c.

Anglo-American Telegraph Company, Limited.

An ordinary general half-yearly meeting of the proprietors in this company was held yesterday (Thursday) at Winchester House, Old Broad Street. The Marquis of Tweeddale, in the absence of the chairman of directors, presided.

The Chairman, in moving the adoption of the report, published in our last issue, regretted the absence of the chairman (Viscount Monck), who was unable to attend through indisposition. Regarding the report, they would observe, no doubt with satisfaction, that the working expenses under B and C showed a reduction of a little over £1,100. The repairs to cables amounted to considerably less than they did at this time last year, the amount being £5,981, as against £9,858. This was accounted for by the fact that the expenses of the ship *Minia* had been charged to the renewal fund, inasmuch as the ship was employed in renewing a very considerable portion of cable which had been destroyed. That item amounted to £15,485 expended during the six months under notice. The repair was a very costly one, and was to the Brest-St. Pierre cable, which was broken in three different places—one place was at a depth of no less than 2,000 fathoms, another at 400 fathoms, and the third at 900 fathoms. The first two cables had been successfully repaired, and attention was being paid to the third, which would have been completed before but for the delay of operations through a fog which prevailed in the neighbourhood of Newfoundland. These repairs had been costly, but, fortunately, they had a very valuable fund to which they had been able to charge the cost of those repairs. That led him to draw their attention to the fact that the renewal fund now amounted to the very handsome amount of £964,600. In reality, however, it was now a good deal more. The investments of the securities would now yield something like £50,000 over and above the cost price. He thought that so far it must be admitted that the features of the report which he had dwelt upon were satisfactory. Not quite so satisfactory, however, was the reduction of the receipts, which amounted to the sum of £19,635. The cause of this was explained in the report, and was due to the fact that the Commercial Cable Company had charged their shilling rate while the Anglo-American Company were charging the sixpenny rate. This lower rate the Commercial Company eventually adopted, and, of course, obtained a considerable addition of traffic, or, rather, subtracted from the Anglo-American Company traffic, which they had been previously enjoying. The only observation which that seemed to call forth was, that it was fortunate that the Commercial Company did not make the change at an earlier date. That brought him to the question of tariff. They were aware that the 6d. tariff was adopted in the hope and belief that it would prove remunerative. It was hoped that the reduction of the rate to 6d. would have the effect of increasing the number of messages to such a degree that the 6d. tariff would become the tariff of the future, agreeable alike to the company and to the public. The experiment having now extended over two years, the company, in common with other Atlantic telegraphic companies, had unanimously come to the conclusion that the 6d. tariff was not only unremunerative, but that it would not be made to pay even within a reasonable time. This was much to be regretted since in the first year the results were most promising. The increase amounted to something like 140 per cent., and if that increase had gone on they would probably not be having the change now. But, as the report stated, the increase ceased about a year ago. They therefore knew pretty well the effect of the reduced tariff upon their finances. The companies having come to the conclusion that the sixpenny tariff was not a paying one, negotiations had been set on foot with a view to raising the rate. These negotiations were now proceeding, and he thought that there was a reasonable prospect of their being satisfactorily concluded within a short time. These negotiations were on the basis of a shilling tariff. If, therefore, they believed that the shilling tariff would not lead to any serious reduction in the number of messages their revenue would benefit very considerably, and he need hardly add that they might hope for a better dividend than it was his duty to recommend on this occasion. He had intended to mention the suit that they had had with the French company. Most of them were aware that the suit had been gained by the Anglo-American Company, and very large damages had in consequence accrued to them. No credit, however, had been taken for any portion of these damages. Therefore, if at any time any portion of these damages came into their exchequer so much the better. He might also add that this French Company had made claims which had delayed the negotiations to which he had referred, and that was why he was unable to report their conclusion.

Sir James Anderson seconded the adoption of the report.

Mr. Smith thought that the time had come when the interest of the renewal fund should be used as revenue. It would increase the dividend on the ordinary stock half per cent., or thereabouts. He made a recommendation to this effect.

Mr. Guesdon suggested that the present method of dealing with the reserve fund was a sound one.

Mr. E. Humphreys having objected to the way in which the report was presented,

Mr. Jackson condemned any attempt to create a fictitious appearance of prosperity. For no less than 15 years not £1 of addition to the capital of the company had been created.

The Chairman, replying to criticisms on the reduced tariff, said that the reduction had been made in consequence of schemes for other lines having been plaiced before the public. This low tariff was unprofitable, but they must not raise it above 1s., or these schemes would be again brought forward.

The report was unanimously adopted.

Mr. Smith formally moved his recommendation, which was seconded by Mr. Newton.

Mr. Guesdon moved as an amendment, "That the disposition of of the interest of the investment of the renewal fund be left to the discretion of the directors."

This was seconded and carried.

The meeting then terminated.

Direct United States Cable Company, Limited.

The twenty-second ordinary general meeting of this company was held at Winchester House, Old Broad Street, on Friday the 20th inst., Sir John Pender, K.C.M.G., chairman of the company, presided.

Mr. T. Finnis, acting secretary, having read the notice convening the meeting, and other formal business having been transacted,

The Chairman, in moving the adoption of the report, which appeared in the Review last week, said: The revenue for the year, after deducting out-payments, and including income tax refunded, amounted to £17,508, and the working and other expenses, including income tax, but exclusive of cost of repairs, absorbed £15,277, leaving a balance of £2,231 as the net profit of the half-year, making, with £9,911 (composed of £6,899, interest on profit, and £3,012 only of principal) transferred from the reserve fund account, a total of £12,142, which has been appropriated to the payment of the following dividends:—interim dividend of 2s. per share for the quarter ending December 31st, 1887, £6,071; and an interim dividend of 2s. per share for the quarter ending March 31st last, £6,071. A final payment of 2s. per share for the quarter ending June 30th is now proposed, making with the interim dividends already paid a total of 2 per cent. for the financial year. The revenue, owing to the low rates current, shows a reduction of £6,064 as compared with the corresponding period of last year. The expenses in London show a reduction of £583 in salaries and an increase of £77 in stationery and printing, the remaining items being about the same as last year. The directors' fees have been reduced by £157, and the use of patents by £123. On the whole, the expenses and other payments exhibit a reduction of £628. The cost of current repairs amounted to £25,222 to June 30th. The investments continue worth much more than their cost to the company. These are the figures, which give you a thorough knowledge of the way in which your affairs have been dealt with during the last six months. When I last had the pleasure of addressing you I went fully into the details of negotiations in regard to raising the rates. As you are aware, we have given the sixpenny rate a thoroughly fair trial; we have been working at it for two years. Some of our friends were sanguine enough at one time, when they saw the traffic going up almost by leaps and bounds, to believe that the sixpenny tariff might eventually prove to be sufficient to enable us to pay a fair dividend. I confess I never believed that it would give us anything like a dividend. The result has been that after two years we are, as you see, paying you a dividend, a small portion of which comes from the working of our system, and a large portion from the interest on our invested reserve. Consequently we are in a position to-day which is not quite creditable to business men. I expressed a very strong opinion when I last addressed you, when I said that I thought the time had come when a conference ought to be held to take this question of advancing the rate into consideration. At that time there were very considerable difficulties. I saw clearly that to press for anything like a conference would do more harm than good; but I saw at the same time that we had made an impression, we had sown seed which was likely to fructify. I am pleased to tell you to-day that those negotiations have been going on more or less ever since I had the pleasure of addressing you. They have culminated now in the Anglo-American Company, the Western Union Company, the Mackay-Bennett Company, and the Direct Company acknowledging the folly of going on any longer on a 6d. rate. We have, therefore, all agreed—there is one exception, and that exception I expect will be dealt with on Monday, that is the French Company; but when I tell you that the French Company a year or so ago were most anxious that we should go up to a 1s. 8d. rate, you will see that it is scarcely likely that they will desire to keep the rate at 6d. now. There were good reasons then for not acquiescing in their wish. We had entered upon a war of rates, and we had to see how far the different parties were satisfied with the result of that. We have proved by going down to 6d. that that is unsatisfactory. But the French Company's representatives will be here on Monday I expect, and I see no reason why they should not agree with us. I think we may assume that they will agree with us; and if they do the result will be that on August 15th we shall be working at 1s. instead of 6d. If we get all the traffic at 1s. that we have got at 6d., it will put us very much in the position we were in when we were paying you fair and respectable dividends. If the public will not support us it will be for our consideration a year hence—because we should give the thing a trial for a year—whether we should not again raise the rates, because I hold that a commercial undertaking is not well managed, nor fairly conducted, either for the shareholders or the public, when it is working under prime cost. But we shall endeavour during that year to do the best we can to develop that traffic and to serve our customers well, and if we can establish a 1s. rate as a permanent rate, I think we shall have done good service to the shareholders, and a very beneficient act for the great telegraphing public. I think you may look forward with perfect confidence to having a 1s. rate established, and at a very early period. Everything is to be fair and above board; there are to be no rebates, or anything of that kind. If there is any departure from the present arrangement, I shall not hesitate to post the delinquents as soon as I get the opportunity. I had hoped to give you to-day a second budget of good news. I had hoped to be able to tell you that our cable was repaired and in thorough working order; I am unable to tell you that, but we have taken one of the important faults out of the cable, and to do so have lifted the cable in 2,200 fathoms of water. That is a very great event in submarine telegraphy, to lift in that depth a cable that has been lying in the sea for nearly 14 years. It is one which scientific men must recognise as one of the great features of the time; it is one which those interested in submarine telegraphy must recognise as giving stability and character to the property which some have possibly not felt to belong to it up to this time. The reason why you have not heard to-day of the completion of the repairs, is that which everybody is complaining of at the present moment—the weather. I believe there has been very stormy weather in the Atlantic, and as you know it is impossible to repair a cable in a storm. We believe the ship is at this moment within 500 miles of the Irish coast waiting for a spell of favourable weather. The amount of cable that we shall put in will give us, I almost say, a new departure. We shall then be able not only to contribute our share to the pool, but shall be able to work our duplex system, which we have not been able to do consequent upon these faults, and therefore take the position which we have always desired to take, of doing a full share, if not something more, of the work of Atlantic telegraphy. Now, gentlemen, I think I have told you pretty well the whole story of the Direct Cable during the last six months. I have shown you that we have done bad business, which I am free to admit. But I assure you that we have done a good business at the same time in beginning and I hope quickening to some degree the conclusion of the sixpenny rate. We have proved that that rate will never pay; it is impossible that it ever can pay. If you are to get such a traffic as will pay at 6d., you must get more capital and more cables to do the work. But the same traffic that we are at present getting, with the 1s. rate, will give us much better dividends than we have been getting for some time past. With these remarks, I beg to move that the directors' report and statement of accounts be and the same are hereby received and adopted, and that a final dividend be now declared of 2s. per share, free of income tax, making with interim dividends already paid, a total dividend of 2 per cent. for the year ending June 30th.

Mr. Wm. Ford seconded the resolution.

Mr. Guesdon enquired whether the arrangement with the other companies was such that the Mackay-Bennett cables were to join in a pool, or whether they were to be in any way favoured, and why the sum in the balance sheet for use of patents was less than it had been. The repairs, he supposed, would be charged to the reserve fund.

The Chairman: We have no pool arrangement. The old pool continues, but the Mackay-Bennett cable simply comes into the arrangement to raise the rate, and they are particularly anxious that the rate should be raised. They were anxious that the rate should go to 1s. 8d., and not 1s. We are the parties that have fought for the 1s. rate. With regard to patents, our cable has been broken down for some little time, as you know, while this repair has been going on. During the total interruption of our cable we pay nothing for patent rights. That accounts for the small reduction you see. As to repairs, we have a contract with the Telegraph Construction Company for carrying out the repairs. I satisfied myself by enquiring elsewhere whether we could do this on better terms, and I was advised by our advising engineers, Messrs. Clark, Ford & Co., before whom I put the whole of the letters which we had, and we accepted their recommendation. They said the Telegraph Construction Company had more experience of the class of cable that we required, and they had to furnish 300 miles of cable. Taking it all round, we found that our best interests were served by putting that contract into the hands of the Telegraph Construction Company. I may tell you, as following up your remark, that it is a thing we could not make a special contract for, we could not specify that it should be done in a particular time, because weather is an important thing. But we did specify this: We paid for the cable and so much for the ship, and it is to their interest as well as ours to show how quickly, how cheaply, and how well they can repair the cable. As to the reserve fund, you are quite right. We do not intend to add one shilling to the capital, but we must take the cost of repairs from the reserve fund. Having drawn from the reserve fund, we are hopeful now to be able to add a little to it, so as to bring it back to the old position. I believe in the reserve fund of a company as the backbone of a concern like this.

Mr. Jackson, after expressing his gratification at the conclusion to which the companies had come to terminte the sixpenny rate, said he thought there should be a general manager appointed to take the place of Mr. Fuller.

The Chairman said that when it was found that it was not likely that Mr. Fuller would recover from the terrible calamity which befel him, he (the chairman) laid a scheme before the board which rendered it unnecessary to appoint another general manager, and thus effected a considerable economy. For all practical purposes he himself might be regarded as the general manager. When the time came that they would be able to afford it he should be only too pleased for a manager to be appointed, who might be depended upon to fairly look after the interests of the company.

Mr. Fry asked if the French Government were to come back to the pool.

The Chairman said he could not answer that now. They were in the hands of the law, and while the suit was still unconcluded, he preferred to say nothing about it. He might say, however, that the French Company had by this time discovered that they were in a far worse position than they would have occupied had they remained in the pool.

Mr. Newton and others spoke at some length upon the numerous engagements of the chairman, and contended that it was not right for him to endanger his own health and their interests by undertaking further duties as general manager of the company. They thought a general manager should be appointed. Sir John was a director of 16 companies, of seven or eight of which he was chairman. After some further discussion with reference to the number of directors and their fees, the motion was carried, the retiring directors and the auditors were re-elected, and a vote of thanks was accorded to the chairman.

Eastern Telegraph Company, Limited.

THE 32nd half-yearly ordinary general meeting of this company was held on Thursday, the 19th inst., at Winchester House, Old Broad Street. Sir John Pender, K.C.M.G., chairman of directors, presided.

The report for the six months ended 31st March last was published in abstract in our last issue.

The Chairman, in moving the adoption of the report, said that the revenue for the past six months was £359,706, as against £331,862 in 1887, an increase of £27,844. Included in these figures was an amount of £31,200, being dividends on shares in the Eastern and South African Telegraph Company. This, compared with £23,400 last year, was an increase of £7,800. As stated in the report, nearly the whole of the shares in the Eastern and South African Telegraph Company belonged to the Eastern Company, and it was therefore most important that it should receive a dividend of two per cent. more than it did last year. Owing to an interruption of the cable, the Black Sea Telegraph Company showed a falling off of £1,300. This company had a smaller interim dividend than usual, but they were not without hope that before the end of the year the final dividend would in some measure make up the deficiency. The Direct Spanish Company, over which the Eastern Company had a controlling influence, having yielded £675 as against nothing, had now turned the corner, and would, it was expected, give a good dividend to its shareholders. This was caused by an increase of work. The amount written off for depreciation of cable stores was £2,150 more than usual, and they had also written off on the cost of electric lighting plant £1,000 more than this time last year. The general expenses in London had been £8,833 against £8,169 in 1887. The working expenses at stations had been £62,786 against £60,674, an increase of £2,112. The principal increase under this head was maintenance and renewals of electrical instruments, £1,093. There was also a large increased expenditure in sending new instruments to Suez, Aden, Bombay, and other places. They had opened a new station at Cadiz which involved some expense, but this would be a feature of the general system. The expense of repairs and renewals amounted to £38,412 against £43,903, a decrease of £5,491. After charging all expenses, including interest on debentures and income tax, they were able to pay a dividend of 5 per cent. and a bonus for the year of 1 per cent., making together 6 per cent. per annum; and to carry to the general reserve fund £75,000, and a small balance of £884 to the next account. The total amount of reserve was £362,606. They had also charged the amount expended on the new schooner-steamer *Amber* to the shipping fund. With regard to the success of the company there was a very remarkable instance of the strong position which their stocks held on the London market. That they issued 4 per cent. debentures at a premium was the best evidence he could give of the confidence of the commercial community in London in this undertaking. It would also be seen that the total capital amounted to £5,900,000, and the capital expenditure to £5,965,006. They proposed to make arrangements for disposing of £62,000 6 per cent. debentures to the Spanish Company, so that when that was complete the capital expenditure would practically balance. They would then be able to increase the investments. They had so far been able to keep down the capital, and he hoped that in the future they would maintain steady and respectable dividends at the same time that their reserve was increasing. The reserve was a most important fund in connection with such an institution as this. With a strong reserve at their back their shares could be maintained, not only in the market, but as an investment. As an investment they found that men were becoming proprietors who, years ago, would not have considered it at all an investment in which they might put their money. In conclusion, he would summarise the accounts as briefly as possible. The gross revenue was £27,844 more than that of last year. The balance brought forward from last year was £16,306 more than the corresponding period of 1887, and the total expenses, including ships and income tax, was £3,341 less. They were, therefore, able to place £27,000 more to the reserve fund, and to pay £19,000, or half per cent. more bonus, than the corresponding period of last year. This was a most satisfactory statement. His prophecy at the last meeting, that they would be able to pay a one per cent. bonus, and so regain the position which they had formerly held, was fulfilled. During the past twelve months, he might add, they had extended their system by the laying of a third line from Port Porthcurnow to Lisbon, Gibraltar, Malta, and Zante. This gave them an improved cable which rendered them independent of the French line through France. But while being able to work without the assistance of the French line, they were still anxious to make their system as efficient as possible by utilising other cables. They had, therefore, been negotiating for a considerable time with the French Government, but there had been difficulties in the way connected with the Channel cables, and it was only the other day that an agreement had been completed by which the submarine system was merged into the Government system. By that they would benefit to some extent, and it would leave the French Government free to deal with them with regard to the line through France. If they could get the concession on reasonable terms they would complete negotiations, but the present position of the company rendered them independent of the French line, whether France agreed or not. A spirit, however, was now abroad amongst nations that this great system was more or less international, and that while contributing nothing they received the same advantages from the system as those possessed by England. This was gaining ground so far that he hoped the future would find less difficulty in negotiating with foreign Governments than in the earlier days of the work. There were difficulties in Portugal, where there was a fair disposition to meet them. They would encourage that disposition, as the more "feeders" they had and the more they could interest other nations in the system the better it was for the shareholders. They were, as he had said, doing satisfactory business with the Cape. They felt, however, that that system was not as perfect as could be desired. They had only duplicated up to Aden, and a very small portion of the line was duplicated between Zanzibar and the Cape. They were now about completing arrangements by which they would receive an alternate line from the Cape joining their system at St. Vincent, and to utilise the cables that had lately been laid along the West Coast of Africa, giving them an alternate line. In other words, it placed them in such a position of independence as to materially strengthen the Eastern Company. The Eastern Company was the parent company, and was the owner of the Eastern and South African. The Eastern Company would to a very large extent control this new system, with which he (the chairman), Sir James Anderson, and one or two others were connected. He would mention one circumstance, just to show how rapidly interruptions were dealt with. They worked in connection with the Eastern Extension Company. The Eastern Telegraph Company was a large "feeder" to them homewards, and the Extension Company was a large "feeder" to the Eastern Company outwards. Three weeks ago, by an extraordinary coincidence, all these cables ceased to speak at the same moment. Without hesitation steps were taken, and the interruption was now remedied, one of the cables having been repaired. The advantage of working the two companies together was immense, and he mentioned this circumstance because, if they had opposing interests, they could not have done the repairs in the time. He might also remark that they had a large sum towards increasing their carrying power. He moved "That the printed report and accounts of the directors to March 31st, 1888, submitted to this meeting, be and the same are hereby received and adopted; that a dividend on the preference shares of the company to June 30th, 1888, at the rate of 6 per cent. per annum, be paid, less income tax; and that, in accordance with the directors' recommendations, a dividend be and is now declared of 2s. 6d. per share, at the rate of 5 per cent. per annum, with a bonus of 2s. per share, or 1 per cent., both free of income tax, on the ordinary shares of the company, making the previous payments by way of dividend on account a total payment of 6 per cent. on those shares for the year ended March 31st, 1888."

The Marquis of Tweeddale seconded the motion.

The Chairman, replying to Captain Goodsall, said that the distance from Port Porthcurnow to Zante was 2,728 miles. The *Amber* was paid for out of the reserve fund, the cost being something over £29,000.

The motion was carried unanimously.

A vote of thanks to the chairman and to the officers terminated the proceedings.

The Globe Telegraph and Trust Company, Limited.

THE report of the directors, with the balance sheet and accounts for the year ending 18th July, 1888, states that the net revenue of the company for the year, after deduction of expenses, amounts to £168,053 13s. 2d. which, with the balance of £1,442 6s. 8d. brought forward, make a total of £169,495 19s. 10d. From this amount there has been distributed the sum of £114,023 14s. 9d. in interim dividends, leaving an available balance of £55,472 5s. 1d.

The directors recommend payment of a final dividend for the year of 3s. per share on the preference shares, and of 3s. per share on the ordinary shares, making, with the former distributions, a total dividend for the year of 6 per cent., less income tax, upon the preference and 3¼ per cent. net upon the ordinary shares (against 2¾ per cent. for the preceding year), and carrying forward a balance of £2,107 1s. 3d. The directors hope that before long an arrangement will be made whereby a remunerative tariff may be established for Atlantic messages.

The Imperial German Government having acquired the lines of the German Union Telegraph Company of Berlin, the German Union Telegraph and Trust Company will cease to exist at about the end of the present year. This is a measure in furtherance of the acquirement of the Channel cables by the Governments. The board have reason to believe that the return on the capital of the German Union Telegraph and Trust Company, in which this company holds largely, will be about par, while on the preference shares of the German Union Telegraph Company of Berlin held by this company there will be a profit on capital account of about 20 per cent.

In pursuance of agreements made between the Western and Brazilian Telegraph Company and the London Platino Brazilian Telegraph Company, the shares of the latter company have been exchanged for an equivalent in the Western and Brazilian Telegraph Company's shares. The board hope that the revenue on this item in their accounts will be augmented in the future.

During the past financial year a further quantity of 2,000 ordinary shares of £15 each of the Western and Brazilian Telegraph Company shares have been acquired in exchange for preference and ordinary shares of this company. Fifty-nine shares of the German Norwegian Telegraph Company have been drawn for amortisation, and paid off at par, less exchange.

In conformity with the articles of association, the Marquis of Tweeddale and Mr. Henry Daniel Gooch, two of the directors, retire, but, being eligible, offer themselves for re-election. The auditors, Mr. John George Griffiths, F.C.A. (Messrs. Deloitte, Dever, Griffiths & Co.), and Mr. William Griffiths, B.A., Barrister-at-Law, also retire at the meeting, and offer themselves for re-election.

The Cuba Submarine Telegraph Company, Limited.—At a meeting of the board of directors of this company, held on Wednesday, the 25th inst., the audited accounts for the half-year to June 30th were submitted, and it was resolved, after providing for the dividend on the preference shares and placing £6,000 to the reserve fund, to recommend the payment of a dividend on the ordinary shares at the rate of 9 per cent. per annum, tax free, leaving £1,195 to be carried forward to the current half-year's account.

TRAFFIC RECEIPTS.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending July 20th, 1888, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £3,924.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1886

8040. "Improvements in regulating alternating electric currents." C. Zipernowski, M. Deri and O. T. Blathy. Dated June 16. 8d. The object of the invention is to regulate the intensity or the tension of alternating electric currents by means of induction coils or transformers. If it is desired to have two alternating currents with their current strength in a determined ratio to one another, the currents are caused to traverse the two bobbins of an induction coil, the numbers of windings of the said bobbins being in a ratio to one another, the inverse of that of the intensities aimed at. If more than two currents require to have determined intensities, each two of them will have to pass through a coil. Or coils with more than two bobbins may be used, the numbers of windings of which are in the inverse ratios of the intensities of the respective currents. The claims are 3 in number.

3556. "Improvements in the manufacture of sugar by electrolysis." E. Fahrig. Dated March 13. 8d. Consists in conducting through vats or vessels containing the raw material (whether cane, beetroot or any other suitable material) in a ground and dry state, the positive and negative currents evolved from, first, a "high tension" dynamo, by means of sieves or networks of platinum or plated with platinum or other inoxidisable or semi-inoxidisable metal, placed in the vat or other vessel used for holding the raw material, and separated by non-conducting plates of suitable material; and secondly:—the two currents from a "low tension" dynamo by means of negative and positive conductors, one of which is formed into a vessel to enclose the other and the raw material, the waste material which by the action of the electric current is deposited upon the negative conductor being carried off by a current of water suitably applied, leaving the pure sugar within the vessel. Claims:—1. The combination of networks, or sieves of platinum or other inoxidisable metal or semi-inoxidisable metal, and non-conducting plates, with a high tension dynamo, substantially as described and shown in the drawing for the purpose set forth. 2. The combination of a "low tension" dynamo with positive and negative conductors, substantially as described and shown in the drawing for the purpose set forth.

4915. "Self acting electric burglar alarms." J. May. and G. J. Hutton. Dated April 8. 8d. Claims:—1. In an electrical burglar alarm the combination of an electric bell relay with a double acting switch and three independent circuits, arranged to act substantially in the manner and for the purposes described and represented in the drawings. 2. The use and application of an electric relay, as and for the purposes set forth. 3. The improved arrangement and construction of electric burglar alarms in which a constant current circuit is completed through the ordinary fastenings or special contact pieces arranged in or on the doors or windows, or on plate chest, safes, and similar receptacles, and—if any of them are opened, disconnected or unfastened, the wires severed, or the circuit otherwise broken—an alarm given, substantially in the manner described and represented in the drawings. 4. The improved construction of electrical burglar alarms, arranged to act substantially in the manner and for the purposes described and represented in the drawings.

5092. "Improvements in thermo-electric generators." A. Rust. Dated April 12. 8d. The alloy in a melted state is cast upon the wire gauze connections, and so an intimate contact is obtained. Claim:—A thermo-electrical generator, consisting of blocks of antimony and zinc or other suitable metal or alloy connected by wires of iron or other suitable metal, substantially as described.

6598. "Improvements in electrical switches and regulating apparatus." R. H. C. Nevile. Dated May 17. 11d. Consists first in an improved form of switch, by which the contact is shifted without breaking the circuit from one point to the next, and at the same time the two points are short circuited or connected together for an exceedingly short space of time, however slowly the controlling apparatus be moving. This is obtained by the use of special form of a gravity contact. A controlling arm acts upon the inside of a V-shaped piece, which is pivoted below its centre of gravity; this is connected by a pin working in a slot or other suitable arrangement with another piece also pivoted below its centre of gravity, and which carries the contact makers in such a way that the movement of the V-piece does not affect the other piece until its centre of gravity has been moved past the vertical line through its point of support. The V-piece is then free to fall over to the other extremity of its travel, and does so suddenly, taking with it the other piece to which are attached the contact makers, and in this way the contact is completely shifted from one point to the next in the shortest possible time, however slowly the controlling arm or other apparatus controlling the V-piece may move. The contacts are made preferably by mercury, but springs or other suitable contrivances may also be used. Any number of these switches may be grouped together in a circle or straight line, and all the V-pieces may be moved by one arm acting either radially or moving parallel to itself, according as they are arranged in a circle or a straight line. The arm or controlling apparatus may be actuated by hand or caused to move automatically by clockwork. The claims are 5 in number.

1887.

5648. "Improvements in apparatus for making and breaking electric circuits." J. H. Holmes. Dated April 18. 8d. The switch is arranged in such a manner that the movable conducting contact piece which makes and breaks the electric circuit is urged into either the "on" or the "off" position solely by the force of a spring or equivalent, and is not moved by direct pressure exerted through a rigid portion of the handle. The force of the spring is exerted between the handle and the contact piece, and not between the base of the switch and the contact piece; and the direction of the force exerted by the spring upon the contact piece is altered by moving the handle round its axis in either direction. As the handle approaches the end of its traverse it passes a dead point, and the strong force exerted through the medium of the spring on the movable contact piece changes its direction and rapidly urges the contact piece in a direction to close the circuit if open, or to open the circuit if closed. The handle and the contact piece are both pivotted, and the arrangement is such that they constitute a pair of pivotted levers with a spring pressure tending to draw or move the levers together in either of the two directions, so that when one of these levers is moved by the operator through a sufficient distance, the direction of the force which the spring exerts will be changed so as to draw or move the other lever over to the same side. There is one general claim.

6809. "Improvements in electric bell indicators." J. Eshelby and E. Eshelby. Dated May 10. 8d. Claims:—1. In an indicator for electric bells the automatic replacement of disc last used or next room ringing. 2. In an indicator for electric bells the automatic replacement in combination with electrical replacement by one disconnection, as described. 3. In an electric bell indicator an inverted pendulum armature in combination with relay and detaining armature, substantially as described. 4. In an electric bell indicator the electrical cut-out in combination with relay and pick up coils.

6918. "Improvements in telegraphy." W. E. Gedge. (A communication from abroad by A. Claude, Paris.) Dated May 11. 1s. 3d. Relates to a telegraphic system having for object the establishment of apparatus necessary to obtain the following result:—To place in direct communication all the stations of a line so as to permit transmission from any one station without any intervention of the intermediate ones. To permit each station to know the calling or sending station and the called or receiving station upon the line. The claims are 6 in number.

7189. "Improvements in secondary batteries." W. H. Akester. Dated May 17. 8d. Claim:—In secondary batteries the employment of a frame containing cross bars or plates (and sometimes distance pieces), such frame and bars or plates, and also the distance pieces, when employed, being formed of lead and burnt or fused together, suitable layers of horsehair or other material being interposed between the bars or plates, and between the sides of the frame and the nearest bars or plates, substantially as described.

8181. "Improvements in means or instruments for testing submarine electric telegraph cables or for analogous purposes." H. A. Taylor. Dated June 7. 8d. Relates to the apparatus described in the No. of the Review for June 15th, 1888.

8206. "Apparatus for effecting by insertion of a coin the production of electric light for a certain time." D. H. Davies and J. M. Tourtel. Dated June 7. 8d. Relates to apparatus so arranged that the insertion of a coin, such as a penny, enables the operator to close an electric circuit, starting clockwork or its equivalent, which, acting for a certain time, determines the duration of an electric light, as for instance, in a railway carriage. The claims are 2 in number.

8495. "Improvements in electric lamps." A. M. Clark. (A communication from abroad by C. Bertou, of Paris.) Dated June 13. 1s. 1d. The lamps are of the type in which a carbon pencil is caused to abut against an infusible block, and one of the distinctive features of the invention is that the pressure of the carbon against this block is regulated automatically by the effect which the pressure itself exerts upon the feed mechanism. This invention enables the lamp to be regulated in such manner that the predetermined minimum limit of pressure of the carbon upon its abutment shall never be exceeded. The claims are 7 in number.

9598. "Improvements in electrical apparatus for working railway signals." I. A. Timmis. Dated July 7. 8d. The objects of the invention are to provide a simple and economical means for so diminishing or breaking the electric circuit between the battery (which actuates the signal magnet used in the system the inventor employs to actuate signal arms) and the signal magnet that the armature of the magnet is released, and the signal arm can or may go to the position of "danger" automatically by the action of a passing train, thereby enabling the train to protect its rear.

14622. "An improved electric accumulator." E. E. Vaughton. Dated October 27. 8d. The inventor makes the plate which carries or supports the reducible agent with the edges turned upwards and preferably inwards on one or both of its sides or surfaces. The plate also is closely perforated, and in the case of the one with the upturned edges on one side or surface only he countersinks the holes on the reverse surface. He places India-rubber or other suitable non-conducting material between the outer or inactive sides of the electrodes and the walls of the cell and covers the inner or active sides of the electrodes with asbestos or other suitable porous material. Between the electrodes so covered he packs perforated plates or pieces of vulcanite or other suitable non-conducting material for the purpose of separating the electrodes and keeping them firmly in position. The claims are 7 in number.

15537. "Improvements in electric switches." R. W. PAUL. Dated November 14. 8d. The object of the invention is the improvement of electrical switches in such a way as to secure an instantaneous making and breaking of a circuit or circuits, which instantaneous making or breaking is not directly affected by the motion of the handle of the switch except at a certain portion of that motion, and at the same time to secure the automatic locking of the movable contact piece or pieces, either in the "on" or "off" position, by other means than friction, which is apt to be uncertain. The claims are 7 in number.

15717. "Electrical date and time stamp." C. A. RANDALL. Dated November 16. 1s. 1d. The instrument is controlled from a central or controlling clock, and automatically changes the day, hour and minute type wheels, in their order, by electrical impulses sent by the clock once per minnte, from which type wheels impressions can be taken upon valuable papers of record, finance, &c., or other paper. The claims are 10 in number.

17047. "Improvements in secondary batteries." F. KING. Dated December 10. 8d. The inventor connects together the whole of the plates or elements of one denomination in each cell (preferably the negative pole or spongy metallic plates) by affixing on both sides a metal strip, or bar, standing out from the edges of the plates in any convenient position. Upon this strip or bar he places insulating material, preferably in the form of saddle pieces, which may have grooves or guiding pieces on the upper side for studs or projections on the plates or elements of the other denomination to fit into or upon so that this strip or bar, insulated as described, serves to support the plates or elements last mentioned. At the bottom, and preferably at the corners of the negative pole or spongy metallic plates, he may use lugs or feet of any convenient form or length which may be connected together by a strip or bar so that the entire section of plates is supported and kept clear of any active material which may fall to the bottom of the container. The claims are 9 in number.

CORRESPONDENCE.

Galvanic Belt Quackery.

The following correspondence has just been forwarded to me by a friend of mine whose wife was silly enough to apply to the President of the British Association of Medical Electricians on the strength of the half-page advertisement which recently appeared in the *Daily Telegraph*, respecting the wonderful and scientifically-constructed electropathic belt :—

Dear Sir,—Seeing your advertisement in the *Daily Telegraph* a few weeks ago, I wish to lay my case before you, and if you consider your electropathic belt would bring about the desired effect, will you kindly inform me the price and what hours of the day the belt is to be worn. I have been married for six years, and although my husband and I are anxious to have children, up to the present I have not given birth to a child. I suffer at times from nervous debility. I want you, if you will kindly, to let me have a reply per return, as I feel confident your belt will bring about the desired effect.

Yours truly,

———

Madam,—I am in receipt of your letter of yesterday, and in reply have pleasure in sending you a special pamphlet, in which you will find a chapter upon the matter concerning which you wish for advice. Please give me particulars requested in the consultation form, and when doing so you may without hesitation state your private address, as all matters here are regarded as strictly confidential.

Yours faithfully,
C. B. HARNESS.

The chapter referred to in the President of the B.A. of Medical Electricians' pamphlet, which is, in my humble opinion, rather a filthy production—I enclose the pamphlet for your inspection — is entitled "Sterility," and, with your kind permission, I will quote a few passages therefrom to show how cunningly the chapter is worded :—"Love of children lies dormant in the breast of every properly-constituted man and woman," "misery is likely to result from sterile marriages ; how many a home is rendered cheerless by a bitter disappointment which blights the happiness of two persons who entered the holy state of matrimony with every prospect of fulfilling the *Divine* command to 'increase, multiply, and replenish the earth.'" Attention is drawn to Anne of Austria, Queen of France, who gave birth to a child after having been married twenty-two years ; also to Catherine de Medicis, wife of Henry II., who became the mother of ten children after ten years' sterility.

What No. belt does the eminent electrician recommend for cases similar to the foregoing, I wonder ? Such cases, writes the "eminent one," have been treated successfully by the electropathic method.

Following this chapter on "Sterility" is a note stating that the "Medical Battery Company undertake to remove superfluous hairs, moles, and other disfigurements by the electrolytic action of electricity."

All instances where advice as to electropathic treatment is sought by *ladies* suffering from any of these ailments, each individual case has the worthy president's own special attention, and, whether advised upon in personal consultation or by correspondence, is regarded as *strictly private and confidential.*

What man on earth who has the faintest idea of the science of electricity and magnetism, would require to examine the electropathic belt twice to be convinced of its utter uselessness as an electrical curative agent ? Yet Dr. Andrew Wilson writes in *Health* : "I observe that the Medical Battery Company, whose belt has been frequently recommended in *Health* as one of the very few genuine electrical appliances which the public may purchase with safety and satisfaction." "In these days of electrical quackery," continues the doctor, "it is highly satisfactory to find that an enterprise for development of electrical manufacture on a large scale has been successfully projected." I can only advise the learned doctor, if he be still in existence, to read, mark, learn and inwardly digest your report on "an electropathic belt."

From a little incident which has just come under my notice, I find the "eminent electrician" is still on my track, but I can assure him I treat him pretty much as I should a little insect, the name of which is well known to most people, in fact, not so much, for one stings a trifle and the other tries to sting, but fails in the attempt. In conclusion, I shall be glad if you will allow me to state that the scheme for the extermination of medical quacks and bogus belt advertisers is progressing very favourably indeed.

J. Jerritt, A.S.T.E & E.

July 23rd, 1888.

[It is decidedly time, as matters now stand, that something should be done to prevent the female sex from consulting an unqualified practitioner. Mr. Jerritt's letter should have the effect of rousing a feeling of indignation throughout the whole medical profession, but this alone is not enough. The practice must be absolutely forbidden by law, and the necessary steps to effect this much desired consummation could readily be taken if only doctors would look more after their own interests.—EDS. ELEC. REV.]

Dynamo Construction.

If your correspondent Mr. McLean uses mica plates to insulate his commutator bars he will get satisfactory results, as mica is much better for this purpose than any other substance.

Your leaderette on the subject of high E.M.F. on "Gramme" commutators ought to open up a very interesting discussion.

Having had some experience in this matter, I may say that it is perfectly easy to construct a "Gramme" commutator for 500 to 800 volts, and that the sparking is not more pronounced than on machines giving 60 volts. Of course it would not do to make a commutator for 800 volts with only 40 sections, and with thin insulation between the bars. I have found with mica insulation $\frac{1}{16}$ inch thick that 10 volts per bar is a safe limit within which to work, thus 800 volts will require a commutator with at least 80 bars, and 3,000 volts one with 300. It may seem that a commutator with 300 bars would be expensive to renew, but when it is remembered that such a commutator will last six or seven years of ordinary lighting work, this possible objection would disappear.

Discussing the commutator naturally leads to the consideration of the other parts of a high tension arc lighting machine. The commercial efficiency of prominent arc lighting dynamos is very low; it would be interesting at the present time to know what is the commercial efficiency of the "Brush" and Thomson-Houston machines at full, half, and quarter load. I should be very much surprised if the maximum of either of these machines reached 85 per cent.

I think it is a reproach to electrical engineers that the arc lighting dynamo has not been brought to the same perfection as the machine for constant E.M.F. It is certainly within the limits of possibility to produce a machine that will give a constant current, and yet have a respectable efficiency, say 95 per cent., and the writer's experience shows that a properly designed shunt wound machine goes a long way towards this desirable result. Of course, it may be objected that shunt winding for the very high E.M.F. required is expensive; but to this it may be replied that the list prices of most arc lighting machines are still high enough to allow of them being shunt wound, without the necessity of an advance in price; at the same time a saving of from 10 to 15 per cent. in the coal bill would be duly appreciated by the user. Shunt wound machines for arc lighting cannot be used in all cases, as if only two lamps were on a very short circuit, the machine would not build up.

Considering the bad effect of heat on insulation, arc lighting machines should be built to run cool. This can best be done by using only one layer of wire on the armature. This construction, even for 3,000 volts, offers no difficulties, and only a moderate sized armature is required.

Hoping this subject may receive in your columns the attention its importance demands.

William H. Eaves.

Coventry, *July 23rd*, 1888.

A Correction.

With reference to your mention in last week's issue of my appointment to Messrs. Woodhouse and Rawson, Limited, I beg to inform you that the same was premature and was occasioned by negotiations which have since proved unsuccessful.

A. Reckenzaun.

July 25th, 1888.

[We do not feel ourselves in the least responsible for the statement to which our correspondent takes exception, as Mr. Rawson gave us his guarantee in a private note that the facts were correct.—EDS. ELEC. REV.]

Electrical Locomotion.

Referring to the article by Mr. Elieson in your issue of the 6th inst., and my note thereon in last week's ELECTRICAL REVIEW—first, as regards Mr. Elieson's attack on the first electrical tramcar operated in this country.

Although the arrangements for running it here were made by me, and a series of demonstrations and runs with it carried out under my supervision, I did not design it, and can therefore speak of it without any feeling.

Mr. Elieson appears to have made specific statements about this car and its construction whilst being in entire ignorance of what was really operated early in 1882, at Leytonstone.

He says the car was one of the "ordinary size in use," &c., "the motor was coupled with a leather belting transmission and a pulley to one of the axles of the car."

This is entirely incorrect, the car was not one of the ordinary type at all; it was a short car, the upper part of which was largely occupied by accumulators, with a simple roof over, quite open at the sides and ends, supported by iron bars.

When it arrived from the Continent the motion from the motor went to *both* axles through an intermediate shaft; all transmission being through toothed wheels, no belt on the car at all. I found that there was unnecessary frictional losses through this double transmission; that two wheels gave ample adhesion, and therefore disconnected one axle.

Mr. Elieson speaks of it as a system. I don't think there was any system about it. The runs made under my supervision were simply intended to demonstrate that motors and accumulators could be used as a medium for applying power to cars, and to prove for this purpose the fact that the Faure accumulator could be used as a power reservoir.

Mr. Elieson says after several attempts to run it it was abandoned in a field. The car was not abandoned in a field after several attempts to run it, but was turned out of the depôt by the tramway company, because the Faure Company (so I have been informed) took no notice of their repeated applications for its removal. For what it was this car ran for the purpose above stated well enough, there were no abortive attempts to run it at the time; whether the Faure Accumulator Company attempted to use it as a working car or not I do not know; I should say not. The use of a double pair of brushes for reversal is pointed at in the article as if it were a bad feature.

The article says: "It is deplorable to chronicle that every car has been built on almost identical lines, but not decisive enough in their character to secure reliable running."

Now to say that to-day electrical tramcars are a repetition of that used for demonstration at Leytonstone is entirely incorrect.

Those having broad views on electrical locomotion, and realising what the business has in it, hope that Mr. Elieson's work has shown economy over horses, and that he has in hand an extension of his arrangements which will enable still further economy to be shown. Let him give some figures of the same practical character as those by Mr. Reckenzaun, now being published by you.

With properly constructed vehicles, avoiding unnecessary weights and unnecessary losses in transmission, it is a fact that with the results which several accumulator manufacturers are now able to guarantee, there is very large economy in electrical locomotion even by accumulators. And it is undoubtedly by accumulators in the immediate future that the bulk of electrical propulsion in this country will be carried out. In your issue of the 6th inst. there is a letter signed F. C. Allsopp. He speaks of the "miserable performances" of the electric cars operated on the Brighton and Shoreham tramways.

Now, Sirs, it is absolutely untrue to speak of the electric tramcars which were operated some little time ago on the Brighton and Shoreham tramways as miserable failures, and if your correspondent has any interest in electrical locomotion let him endeavour to associate himself with some work and prove an economy and then proclaim his results. From one point of view it may be that silence is the most dignified way of treating what appear to be biassed remarks of this character; on the other hand, I think that those responsible for the cars referred to, tried on the Brighton and Shoreham tramways, should not allow such statements to appear without contradiction.

It must be remembered that capitalists and financial men who are beginning to perceive that there is money to be made in electrical locomotion, may very likely peruse the technical papers for information, and if they see nothing but animosity in the camp, instead of a general desire to compete with other methods of traction at all points, they may well hesitate and become distrustful.

My remarks have spun out to greater length than I intended.

Radcliffe Ward.

July 18th, 1888.

[Mr. Elieson is, we believe, at present on the Continent, but doubtless he will reply to the comments which his article has evoked upon his return.—EDS. ELEC. REV.]

Who is He?

Referring to your remarks in your issue of July 13th in regard to a Mr. J. Morris who it seems places M.S.T.E. after his name, I beg to inform you that no one of that name is a member of the Society of Telegraph-Engineers and Electricians.

F. W. Webb, *Secretary,*
Society of Telegraph-Engineers and Electricians.

4, The Sanctuary, S.W.,
London, *July 19th*, 1888.

[We had indulged in hopes that genial Mr. Webb would have entered somewhat more fully into this matter; as it is, he only corroborates the information which we had already obtained by glancing through the Society's list of members. Perhaps some of our readers can inform us who the individual in question is and where he hails from. This once obtained, Mr. Webb would do well to give him a kindly word of advice respecting his assumption of M.S.T.E.—EDS. ELEC. REV.]

The Incandescent Lamp Patent Case.

I beg to inform you that, having been advised that the decision of Mr. Justice Kay is contrary to decisions in the Court of Appeal and House of Lords, the directors have instructed our solicitor to take the necessary steps for appealing against Mr. Justice Kay's decision.

S. Flood Page, *Secretary,*
The Edison and Swan United Electric Light Company, Limited.

July 19th, 1888.

Telegraph Survey and Construction.

I find in your issue of July 20th that the above subject is re-opened by Mr. Arthur E. Gilbert. From the tone of his remarks, both in this and in his previous letter, he evidently thinks that I am the author of the letter signed "G. A. Neale." As your readers have also been led into the same error, I shall be glad if you will notify in your next issue that I know nothing whatever of the correspondence, nor am I in any way responsible for the statements made in it.

John Neale,
Tel. Supt. and Eng. N.S.R.

Stoke-on-Trent,
July 21st, 1888.

The D'Humy Water Primary Battery.

Having been called unexpectedly to the Continent, I have not been able to reply earlier to your remarks in the ELECTRICAL REVIEW of the 22nd June.

You say that I am careful to avoid "figures," adding that when I am able to give you data, compiled in like manner to that which you give respecting a "really genuine battery which is quite without the realms of mystery," you will be ready to challenge the results, or to verify them.

Among the essentials which, in the opinion of Prof. Silvanus Thompson, go to form an ideal primary battery, is "*a constant current for a considerable period of time*," and you suggest that the improved form of Bunsen battery, which you designate as a "distinct advance in primary batteries, complies with the required conditions, modifying this, however, to the extent that "anything which tends to *lengthen* the period over which a battery of the Bunsen type will give an *approximately constant* current, may be *considered* as a distinct advance in primary batteries."

But when you refer to 31½ hours as being a *lengthened run* for your ideal primary battery, and announce that you then put an end to the experiment owing to your desire not to leave the battery alone through another night, although you had not the least doubt that *several hours* more work could readily have been obtained before the electrical constants were reduced to the extent of rendering it undesirable to continue the readings, leaving entirely out of the question the *fumes* which, after a time, arose from the battery, and which by the employment of proper devices could be rendered more or less unobjectionable, you cannot really be serious in your remark that your ideal has distanced all competitors.

The experiments to which I referred extended over several hundred hours, without any intermission; they were only suspended in consequence of the necessity for the return of the American experts and my presence abroad, but, on my return, the d'Humy battery was still working with every indication that it was capable of so continuing for many years by simply renewing its liquid elements.

You do not demonstrate by your data, nor in any way support your assertion, that 40 hours of "constant and hard work" is really a practical result, and without in any way attempting to depreciate the merits of the invention which has been the subject of your so careful investigation, I repeat, without any fear of contradiction, that the d'Humy primary battery is *perfectly constant* and reliable in its action, is exceedingly economical, requires no skilled attention, and in every respect conforms to your own ideal of a primary battery. I am not by any means alone in my opinions, which are shared by perfectly competent and impartial men, of various nationalities, who have taken the pains to assure themselves that the water primary battery fulfils all the conditions which are claimed for it.

Jno. Thos. Browne, *C.E.*

July 18th, 1888.

[The above letter contains nothing more to the point than did that upon which we commented on the 22nd June. We simply say that before we can accept the statements of Mr. Brownl or anybody else respecting the D'Humy battery we must have figures and not idle ink-slinging. Our contention regarding the Weymersch element does not require any further argument except to those who have yet everything to learn respecting galvanic batteries. If Mr. Brown will set up a Bunsen battery and take from it a 10-ampère current, he need not be surprised to find it useless after 8 or 10 hours' working, and as our report dealt exclusively with a particular type of element we need not discuss this point any further. Perhaps Mr. Brown will allow that the Lalande-Chaperon battery is as constant and as long-lived as the D'Humy, but of what use has it proved itself to be? As sure as our correspondent's name is what it is, he will renounce the error of his ways some day.—EDS. ELEC. REV.]

A Poser.

Some days ago a sparrow was caught among some electric lightning machinery with which the writer is connected. The bird had evidently been injured in some way, and when first caught appeared to be slowly yielding up the ghost. In order to test the "electropathic" method of treatment, a Leclanchè battery was utilised, several shocks being administered to the little patient, with the result of completely reviving it. But now, Mr. Editor, it appears to me that I have completely put my foot in it, and I venture to ask your advice. By ministering to the little chirruper, have I made myself liable to prosecution for infringing the "electropathic" treatment of the mighty C. B. Harness? Will the sparrow also be pounced upon for damages by the august "President of the British Association of Medical Electricians?" Will—but the thought of the thousand and one actions which may be raised freezes my young blood, and makes my hair stand on end like quills on the frightened porker.

R. J. Browne.

Glasgow, *July 23rd*, 1888.